Escola Superior
Saúde
Santa Maria

A INTERVENÇÃO DO ENFERMEIRO ESPECIALISTA EM ENFERMAGEM DE REABILITAÇÃO NA DESCANULAÇÃO EFICIENTE DO UTENTE CRÍTICO:

SCOPING REVIEW

Ana Sofia Castro Correia

Julho de 2023
Porto

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Dissertação no âmbito do Mestrado em Enfermagem de Reabilitação orientada pela Professora Doutora Inês Alves da Rocha e Silva Rocha, coorientada pelo Professor Doutor Abílio Cardoso Teixeira e apresentada à Escola Superior de Saúde Santa Maria.

Julho de 2023
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Existem muitas hipóteses em ciência que estão erradas.
Isso é perfeitamente aceitável,
elas são a abertura para achar as que estão certas.

Carl Sagan

DEDICATÓRIA

À minha doce filha, cuja alegria me deu um norte ao longo do processo.

Ao meu marido, presente nos bons e maus momentos.

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CHAVE DE ABREVIATURAS, ACRÓNIMOS E SIGLAS

ARDS	Síndrome da dificuldade respiratória aguda
AVD	Atividades de vida diárias
DV	Desmame Ventilatório
$ECCO_2R$	Remoção de dióxido de carbono
ECG	Escala de Coma de Glasgow
ECMO	Oxigenação por membrana extracorpórea
EEER	Enfermeiro Especialista em Enfermagem de Reabilitação
EUA	Estados Unidos da América
ICC	*International Consensus Conference*
MRC	*Medical Research Council Muscle Scale*
OE	Ordem dos Enfermeiros
OMS	Organização Mundial de Saúde
ONAF	Oxigenoterapia humidificada de alto fluxo por cânulas nasais
PEEP	Pressão positiva no final da expiração
PFT	Pico de Fluxo de Tosse
PRI	Programa de Reabilitação Individual
SB	Secreções Brônquicas
TQ	Traqueostomia
UCI	Unidade de Cuidados Intensivos
VMI	Ventilação Mecânica Invasiva
VNI	Ventilação Mecânica Não Invasiva
WIND	*Weaning according to New Definition*

RESUMO

Enquadramento: A traqueostomia representa um marco no desmame ventilatório. A remoção da mesma (descanulação), descreve-se como fundamental na reabilitação do doente crítico, onde os enfermeiros desempenham um papel elementar. No sentido de descrever qual a intervenção do enfermeiro no processo de descanulação foi elaborada uma *Scoping Review*, que se apresenta nesta dissertação.

Objetivos: O objetivo desta revisão é mapear e analisar as evidências disponíveis sobre a intervenção de reabilitação na descanulação do doente crítico. O desenvolvimento deste estudo visa a criação de um protocolo que suporte a intervenção de reabilitação na descanulação.

Métodos: Foi implementada a estratégia PCC e as recomendações PRISMA® do *Joanna Briggs Institute*®. Pretendemos responder à questão: "*Qual a intervenção do enfermeiro especialista em enfermagem de reabilitação para uma descanulação eficiente nos doentes traqueostomizados em cuidados intensivos?".* A pesquisa realizou-se no mês de novembro de 2022, com recurso às plataformas *MEDLINE, CINAHL® Complete, Cochrane Database of Systematic Reviews, MedicLatina, Nursing & Allied Health Collection, Scopus®, Web of Science, ProQuest,* RCAPP*, OpenGrey, MedNar e Google Scholar*.

Resultados: Identificou-se a necessidade de avaliação do doente, previamente à descanulação, tendo em consideração os seguintes parâmetros: nível de consciência, dependência de ventilação mecânica, capacidade de tossir, necessidade de aspiração de secreções brônquicas, capacidade de deglutir, permeabilidade das vias aéreas e estabilidade hemodinâmica e clínica. As intervenções sugeridas foram: redução do calibre da traqueostomia, desinsuflação do cuff e implementação de programas de reabilitação individual. Sugere-se a associação da ventilação mecânica não invasiva e da oxigenoterapia humidificada de alto fluxo nas descanulações mais difíceis.

Conclusão: Este estudo permitiu identificar a necessidade de se realizar uma avaliação objetiva do doente previamente à descanulação, como fator preponderante para o seu sucesso. Concluiu-se que a implementação de programas de reabilitação individuais, por equipas interdisciplinares, é fundamental para descanulações bem-sucedidas.

Palavras-chave: Enfermagem, Reabilitação, Traqueostomia, UCI.

ABSTRACT

Background: Tracheostomy represents a milestone in ventilatory weaning. Its removal (decannulation) is described as fundamental in rehabilitation of critically ill patients, where nurses play an elementary role. To describe nurse's intervention in decannulation, a Scoping. Review was conducted, which is presented in this dissertation.

Objectives: The purpose of this review is to map and analyze the available evidence on the rehabilitation intervention in decannulation of critically ill patients. The development of this study aims to create a protocol that supports rehabilitation intervention in decannulation.

Methods: The PCC strategy and the PRISMA® recommendations by Joanna Briggs Institute® were implemented. We intend to answer the question: "*What is the intervention of the specialist nurse in rehabilitation nursing for efficient decannulation in tracheostomized patients in intensive care?".* The research was carried out in November 2022, on *MEDLINE, CINAHL® Complete, Cochrane Database Platforms of Systematic Reviews, MedicLatina, Nursing & Allied Health Collection, Scopus®, Web of Science, ProQuest,* RCAPP, *OpenGrey, MedNar and Google Scholar*.

Results: The need for evaluation of the patient, prior to decannulation, was identified, considering the following parameters: level of consciousness, dependence on mechanical ventilation, ability to cough, need for aspiration of bronchial secretions, swallowing ability, airway patency airways and hemodynamic and clinical stability. The suggested interventions were: reduction of tracheostomy caliber, cuff deflation and implementation of individual rehabilitation programs. It is suggested the association of non-invasive mechanical ventilation and high flow humidified oxygen therapy in the most difficult decannulation.

Conclusion: This study identified the need for an objective assessment of the patient prior to decannulation, as a preponderant factor for its success. It was also concluded that the implementation of individual rehabilitation programs, by interdisciplinary teams, is fundamental for a successful decannulation.

Keywords: Nursing, Rehabilitation, tracheostomy, UCI.

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INTRODUÇÃO

A Enfermagem é uma disciplina com elevada evolução e desenvolvimento nas últimas décadas, quando comparada a outras áreas da saúde (Post University, 2021). Neste pressuposto de exigência, pretende-se que a comunidade possa usufruir de cuidados de enfermagem especializados, que respondam de forma competente às mudanças que se espelham nas necessidades demonstradas pela mesma.

Atualmente, encontramo-nos num período pós-pandémico. A comunidade apresenta inúmeras complicações resultantes desta época de carência de resposta, por parte do sistema de saúde (Haileamlak A., 2021). Este período tem representado um desafio para a Enfermagem, nomeadamente, para os Enfermeiros Especialistas em Enfermagem de Reabilitação (EEER).

Perante a observação das limitações apresentadas pelos doentes neste período, associada à falta de recursos que cumpram uma resposta adequada a este novo contexto, e no sentido da aquisição de aptidões para prestação dos cuidados mais adequados às necessidades da pessoa, surgiu a motivação para desenvolver competências na área de especialização de enfermagem de reabilitação.

Esta fase pandémica gerou um aumento no número de doentes respiratórios, com necessidade de ventilação mecânica (Todi & Ghosh, 2021; Wunsch, 2020). Um dos condicionantes da infeção respiratória por SARS-CoV-2 apresenta-se pela elevada probabilidade de desenvolvimento de pneumonia, com síndrome de dificuldade respiratória aguda grave (ARDS) e consequentemente com desmame ventilatório (DV) difícil e/ou prolongado (Haileamlak A., 2021; Todi & Ghosh, 2021). A traqueostomia (TQ) é uma técnica cientificamente aceite e recomendada como facilitadora, neste tipo de DV (Lim et al., 2015). No período pré pandémico a realização de TQ variava entre oito a treze porcento dos doentes, enquanto que no período pandémico os valores variaram entre dezasseis a sessenta e um porcento (Cheung & Napolitano, 2014; Nadeem, et al., 2021). A descanulação da TQ é um marco muito importante na recuperação destes doentes e deve ocorrer logo que possível (Williams & McGrath, 2021). Compreende-se então que, por este motivo, os cuidados ao doente crítico mudaram muito rapidamente, bem como as necessidades de intervenção do EEER.

A literatura consultada, previamente ao desenvolvimento deste documento, reporta a inexistência de um protocolo definido como ideal para a descanulação

(Aljedaani et al., 2020; Mehta & Mehta, 2017). A necessidade de acesso a cuidados de enfermagem especializados surge neste ambiente particularmente exigente, pois as respostas humanas aos processos corporais, psicológicos e de transição carecem de altos níveis de julgamento clínico e tomada de decisão. Graças ao aprofundamento dos domínios de competências do enfermeiro de cuidados gerais, o enfermeiro especialista alicerça o seu exercício profissional na capacidade de gerar, administrar e supervisionar cuidados especializados (Regulamento n.º 140/2019: Competências Comuns Do Enfermeiro Especialista, 2019).

Neste sentido, e enquadrado no ciclo de estudos do Mestrado em Enfermagem de Reabilitação, da Escola Superior de Saúde Santa Maria, em consórcio com a Escola Superior de Enfermagem S. José de Cluny e com a Escola Superior de Saúde Cruz Vermelha Portuguesa - Alto Tâmega, surge este estudo. O plano de estudos deste Mestrado objetiva a aquisição de competências científicas, técnicas, humanas e culturais, que se adequem à prestação de cuidados de enfermagem, especializados na área da reabilitação, bem como, de competências acrescidas no domínio da investigação, como regulado pela Ordem dos Enfermeiros (OE) (Regulamento n.º 392/2019: Competências Específicas Do Enfermeiro Especialista Em Enfermagem de Reabilitação, 2019) e pelo regime jurídico dos graus e diplomas do ensino superior (Decreto-Lei n.º 65/2018 Do Ministério Da Ciência, Tecnologia e Ensino Superior, 2018).

O desenvolvimento de investigação sobre esta temática, baseada na evidência científica publicada, considera-se relevante para dar resposta a este problema identificado no contexto das unidades de cuidados intensivos (UCI). Com o objetivo de responder à questão de investigação: "Qual(is) a(s) intervenção(ões) de reabilitação que promovem o sucesso na descanulação do doente critico?" a autora desenvolve uma revisão do tipo *Scoping*. Por sua vez, considerando a atuação específica do EEER, estabelecem-se como objetivos específicos:

- Perceber o conceito de doente crítico e UCI;
- Identificar a precedência da TQ;
- Elucidar sobre o papel da enfermagem de reabilitação no DV e descanulação;
- Delinear um protocolo de atuação de reabilitação para a descanulação;
- Identificar quais os diagnósticos e intervenções do EEER implementadas;

- Desenvolver competências de investigação, no âmbito da realização de revisões da literatura.

Para concretizar o objetivo geral e os específicos, desenvolvemos este estudo, cuja organização seguidamente se apresenta. O primeiro capítulo descreve o enquadramento conceptual, onde se introduz a temática em estudo e se sintetiza a informação complementar adquirida. Para isso abordam-se as temáticas: doente crítico e UCI's, visão histórica da TQ e a sua relação com o DV, os unidades de DV especializado, o papel do EEER neste processo e a sua representatividade mundial. No segundo capítulo, descreve-se, de forma breve, o enquadramento metodológico do presente estudo. O terceiro capítulo diz respeito ao artigo I, composto pelo protocolo da *scoping review*, sendo que no quarto capítulo se apresenta o artigo II, correspondente à *scoping review*. De salientar que estes capítulos foram redigidos tendo em consideração as normas das revistas onde foram submetidos para publicação. No quinto capítulo apresenta-se a sugestão de um protocolo de ação, onde se sumarizam os principais achados deste estudo, por forma a serem implementados na prática clínica diária em UCI. Por último, apresentam-se as considerações finais, com referência às limitações encontradas e sugestões para futuros estudos, seguidas das referências bibliográficas consultadas.

1. ENQUADRAMENTO CONCEPTUAL

O desenvolvimento de um trabalho de investigação deve ser precedido de uma exploração dos domínios e conceitos estudados. Este capítulo pretende dar resposta a essa necessidade apresentando-se, assim, alguns dos conceitos representativos das variáveis em estudo, bem como da pertinência da investigação neste campo concreto.

Desta forma, serão apresentadas as definições de doente crítico e das UCI's, a história da TQ e o seu relacionamento com o DV, as unidades de DV especializado, a importância da atuação do EEER ao longo deste processo, a sua representatividade mundial.

1.1. O doente crítico e as unidades de cuidados intensivos

Pode definir-se doente crítico como aquele que se encontra em necessidade de cuidados intensivos. Os conceitos *critical illness* e *critical care* são comumente utilizados em saúde, mas a sua definição sofre alguma variabilidade em termos mundiais. De acordo com Kayambankadzanja et al. (2022), C*ritical Illness* pode ser definido como um estado de saúde débil, com disfunção multiorgânica e risco de morte, mas com potencial de reversibilidade, desde que prestados os cuidados necessários; enquanto que *Critical Care* define-se como a identificação, monitorização e tratamento de doentes com doença crítica, assegurando a função dos órgãos vitais. Os cuidados prestados a este tipo de doentes devem ser realizados em unidades especializadas – UCI's - com uma equipa interdisciplinar (Kayambankadzanja et al., 2022). As UCI's representam uma localização geográfica hospitalar específica, que se distingue pela presença de inúmeros dispositivos de monitorização, equipas dotadas de profissionais altamente especializados, para que se possa fornecer uma otimização fisiológica do doente, suporte avançado de órgãos e identificação e tratamento de processos patológicos que conduziram ao internamento (Jackson & Cairns, 2021). Estas unidades compreendem a prestação de cuidados e monitorização respiratória, cardiovascular, renal, neurológica, gastrointestinal, entre outras (Jackson & Cairns, 2021).

Atualmente, as unidades de internamento diferenciado são categorizadas por níveis de cuidados, entre I, II e III. As unidades consideradas de nível I disponibilizam monitorização (habitualmente não invasiva) e tratamento do doente em articulação próxima com unidades mais diferenciadas. As unidades de nível II, também denominadas de unidades de alta dependência, preveem o suporte da falência de um único órgão, não

asseguram ventilação mecânica invasiva (VMI) e possibilitam a administração de fármacos vasotrópicos, em doses baixas. As unidades de nível III, vulgarmente conhecidas como UCI's, asseguram o tratamento de disfunção multiorgânica, com todas as monitorizações e terapias necessárias, nomeadamente, VMI, oxigenação por membrana extracorpórea (ECMO) ou remoção de dióxido de carbono ($ECCO_2R$), suporte vasopressor, bomba de balão intra-aórtico, terapias de substituição renal, monitorização neurológica avançada, entre outras (Jackson & Cairns, 2021).

As primeiras UCI's portuguesas surgem na década de 50, pela necessidade de acompanhamento e ventilação de doentes com poliomielite (Paiva et al., 2016). Estima-se que as UCI´s sejam responsáveis por 13,4% dos custos hospitalares e cerca de 4% dos gastos com saúde, em termos nacionais (Paiva et al., 2016). Em 2012, Portugal era o país europeu com menor número de camas intensivas disponíveis (Paiva et al., 2016). Em 2020, com o surto pandémico, conseguiu-se um aumento para 6,4 camas/100000 habitantes (Nunez et al., 2020). No entanto, dados publicados em 2023 continuam a demarcar uma enorme discrepância entre os números encontrados em Portugal e os demais países europeus. De acordo com o *World Population Review* (2023), a Alemanha disponibiliza 29,2 camas por 100000 habitantes, sendo o país europeu com maior índice, enquanto Portugal regressa aos valores pré-pandémicos de 4,2 camas/100000 habitantes. Dos 33 países incluídos, apenas três apresentavam um índice menor que Portugal: China – 3,6; Índia – 2,3 e Sri Lanka 1,6. Mundialmente, o país com maior índice são os Estados Unidos da América (EUA), com 34,7 camas/100000 habitantes (*World Population Review*, 2023).

Decorrente das caraterísticas destas unidades e da tipologia de doentes, é recomendado, nas UCI's de nível III, uma relação enfermeiro/ doente de 1/1 (Marshall et al., 2017). Esta relação pode, em algumas realidades, ser ditada por legislação própria. Em Portugal, a OE regula as dotações seguras para este tipo de unidades. O rácio recomendado para este tipo de unidades é de 1:1. Para as unidades de nível I e II os rácios recomendados são de 1:3 e 1:2, respetivamente (Regulamento N.º 533/2014: Norma Para o Cálculo de Dotações Seguras Dos Cuidados de Enfermagem, 2014). De igual forma, a OE emitiu recomendações face à presença de EEER nestas unidades, sendo recomendada a prestação de "12 horas de cuidados de Enfermagem de Reabilitação por cada cinco clientes, em todos os dias da semana" (Regulamento n.º 743/2019 de 25 de Setembro, 2019). Nas unidades de nível I e II, o número de horas e dias é o mesmo, mas o número de doentes eleva-se para oito (Regulamento n.º 743/2019 de 25 de setembro, 2019). Este

facto torna-se preocupante, uma vez que se estima que, em parte das UCI's portuguesas, estes rácios não sejam cumpridos.

Nas UCI's, uma das intervenções mais frequentes é a ventilação mecânica. Esta subdivide-se em ventilação mecânica não invasiva (VNI) e VMI. As unidades de nível III são aquelas que asseguram cuidados de VMI. Este tipo de ventilação artificial é uma das intervenções, desenvolvidas para a manutenção da função respiratória de doentes críticos, para manter uma adequada oxigenação/ventilação (Walter et al., 2018). É geralmente utilizada quando a capacidade de respiração/ventilação do doente está comprometida, por uma lesão pulmonar, doença respiratória grave ou outra condição médica, que afete a capacidade em fornecer oxigénio suficiente ao organismo (Walter et al., 2018).

A VMI fornece uma pressão positiva nas vias aéreas através de um tubo endotraqueal ou traqueostomia, de forma oposta à fisiologia básica, que assenta na pressão negativa para a entrada de ar nas vias aéreas. Estes dispositivos permitem ventilar o doente, mas também aspirar secreções brônquicas (SB), traqueais ou proteger a via aérea (Peñuelas et al., 2019; Walter et al., 2018). O ventilador mecânico, através de um compressor, gera uma mistura de ar, pré-determinada, com volume, pressão e gazes definidos pela equipa de UCI. O ciclo ventilatório pode dividir-se em quatro fases: Inspiratória, Mudança da inspiratória para a expiratória, Expiratória e Mudança da expiratória para a inspiratória (Walter et al., 2018).

Tabela 1: *Fases do ciclo ventilatório*

Inspiratória	Pressão positiva (para vencer elasticidade e resistência do sistema respiratório – *Compliance* pulmonar).
Mudança da inspiratória para a expiratória	Fase de ciclagem: interrompida a fase inspiratória e iniciada a expiratória.
Expiratória	Saída do volume de ar dos pulmões, de forma passiva e parcial, para assegurar pressão positiva no final da expiração (PEEP). A PEEP previne o colapso pulmonar.
Mudança da expiratória para a inspiratória.	Interrompida a fase expiratória e iniciada a inspiratória. Definida de acordo com a frequência respiratória e *trigger*.

Fonte: Adaptado de Walter et al. (2018)

É importante realçar que a VMI é um procedimento invasivo, requerendo, por parte de uma equipa interdisciplinar, cuidados e monitorização constantes (Rackley, 2020).

Assim, torna-se crucial monitorizar a evolução da condição respiratória que induziu a necessidade de ventilação, bem como a própria dinâmica da ventilação mecânica, uma vez que o apelo exagerado do doente à VMI pode induzir o seu cansaço e o agravamento da situação clínica. Contrariamente, se a equipa interdisciplinar mantém demasiada compensação ventilatória, quando esta já não é necessária, pode estar a induzir o enfraquecimento muscular respiratório do doente (Peñuelas et al., 2019). Compreende-se então que a monitorização contínua e adequada é essencial, uma vez que permite identificar sinais precoces de agravamento clínico e minimizar o risco de iatrogenia (Rackley, 2020).

De facto, existem diferentes modos de VMI que podem ser adaptados às necessidades específicas de cada doente, sendo que, para fornecer uma ventilação corrente sob pressão positiva, os ventiladores integram parâmetros como volume, pressão, tempo e fluxo (cada um como uma variável dependente ou independente) (Walter et al., 2018).

Os benefícios da VMI incluem o tratamento de doentes com insuficiência respiratória hipoxémica e hipercápnica, redução do trabalho respiratório inspiratório dos doentes com choque, reaproveitamento do fluxo sanguíneo dos músculos respiratórios ativos para outros tecidos e permissão do uso de proteção pulmonar (baixo volume corrente) em doentes com ARDS (Grasselli et al., 2023). Permite, ainda, a manutenção da função pulmonar durante procedimentos cirúrgicos e o repouso durante a recuperação após os mesmos (Peñuelas et al., 2019; Walter et al., 2018).

No entanto, a VMI também apresenta alguns riscos e possíveis complicações, como shunt intrapulmonar, barotrauma, infeções respiratórias, lesões pulmonares induzidas pelo ventilador, pneumotórax, aumento da pós-carga ventricular, retenção significativa de sódio e água, atrofia e diminuição da funcionalidade dos músculos respiratórios e aumento da morbilidade e mortalidade, bem como enfraquecimento do diafragma (Buckley & Gillham, 2007). Por estes motivos, o seu uso deve ser judicioso, avaliado, monitorizado regularmente, definindo-se objetivos claros, exequíveis e dinâmicos (Ladeira et al., 2014; Touman & Stratakos, 2018).

Assim que o processo de doença que conduziu à necessidade da VMI estiver em fase de resolução, deve ser iniciado o DV (Vetrugno et al., 2020). A redução/ eliminação

do suporte ventilatório do doente, denominado DV, nem sempre é um processo simples, podendo transformar-se num DV difícil ou prolongado (Burns et al., 2021). O DV prolongado culmina, frequentemente, na confeção de uma TQ aos doentes, por forma a facilitar este processo (Ghattas et al., 2021; Medeiros et al., 2019; Pham et al., 2017; Raimondi et al., 2017).

1.2. Visão histórica da traqueostomia

A TQ consiste num procedimento cirúrgico que envolve a colocação de uma cânula artificial na traqueia do doente, através de uma incisão na região anterior da mesma, para permitir a ventilação/ respiração (Borman & Davidson, 1963). Habitualmente é realizada quando existe uma obstrução ao fluxo de ar nas vias respiratórias superiores ou para realização de VMI de forma prolongada (Agrawal et al., 2021). Este procedimento pode ser executado com caráter de emergência ou de forma eletiva e pode ser temporário ou permanente (Agrawal et al., 2021). Uma das primeiras descrições desta intervenção pode ser encontrada num antigo livro de medicina Hindu (*Rig Veda*), sob a forma de uma referência a um procedimento realizado na Idade do Bronze, cerca de 2000 antes de Cristo (Szmuk et al., 2008). Cinco séculos depois, um médico egípcio, Imhotep, documenta, sob a forma de papiro, um procedimento semelhante à TQ (Cooper, 2016). A ciência egípcia descreve a utilização desta técnica para drenar abcessos e tratar obstruções respiratórias superiores, com referência à utilização de cauterização para controlar a perda sanguínea (Blomstedt, 2014; Szmuk et al., 2008). De facto, a TQ é considerada como um dos procedimentos cirúrgicos mais antigos alguma vez descritos (Mehta & Mehta, 2017; White, 2017).

A primeira descrição científica de sucesso na realização de uma TQ surge em 1546, com a intervenção do cirurgião Antonio Musa Brasavola, para alívio da obstrução das vias aéreas causada por “amígdalas aumentadas”. Entre 1546 e 1833, apenas 28 TQ bem-sucedidas foram relatadas (Cheung & Napolitano, 2014). A sua realização em contexto de cuidados intensivos adquire expressão em 1950, durante a epidemia de poliomielite (Mehta & Mehta, 2017).

Atualmente, a TQ é mais comumente realizada para auxiliar no DV de doentes com VMI prolongada do que para alívio de obstrução das vias aéreas superiores (Cheung & Napolitano, 2014). Em 2014, nos EUA, eram realizadas cerca de 100000 TQ por ano (Cheung & Napolitano, 2014). Verifica-se um crescente aumento do número de TQ

realizadas, associado ao elevado número de doentes que necessitam de VMI prolongada ou que apresentam dificuldades no DV (Abe et al., 2018; Bornitz et al., 2020). Ciaglia (1985) desenvolve uma derivação a esta técnica cirúrgica, realizando uma TQ percutânea. Ao longo dos últimos anos esta técnica foi sofrendo alterações e aperfeiçoamentos (Mehta & Mehta, 2017).

De forma resumida, a TQ cirúrgica refere-se à colocação de uma cânula traqueal, após dissecção de tecidos pré-traqueais e incisão na parede traqueal, enquanto que a TQ percutânea envolve uma dissecção romba do tecido pré-traqueal, seguida de uma dilatação, com recurso a um fio-guia e inserção de uma cânula traqueal, pela técnica modificada de Seldinger (Raimondi et al., 2017).

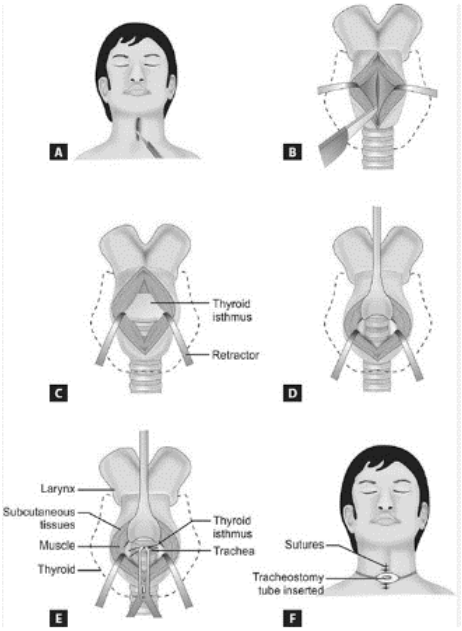

Figura 1: Traqueostomia cirúrgica

Fonte: Bhavana & Keshri (2016)

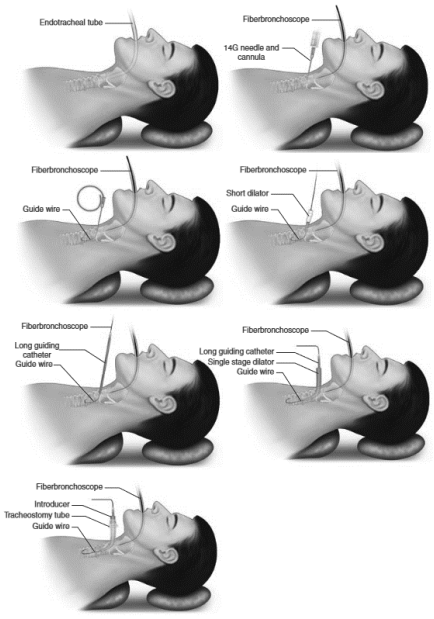

Figura 2: Traqueostomia percutânea

Fonte: Chawla et al. (2020)

Segundo Cheung e Napolitano (2014), a segurança de ambas as abordagens cirúrgicas é similar, estando a técnica percutânea associada a taxas de infeção mais baixas, a um tempo de permanência de cânula mais curto e menores custos. Surgem, entretanto, duas novas derivações à técnica de Ciaglia, a técnica *Ciaglia blue dolphin* e a técnica *Percutwist*, sendo que ambas permitem a realização da técnica em tempos mais curtos (Cheung & Napolitano, 2014).

Recentemente, vários estudos defendem que a associação da imagem ecográfica, previamente e durante o procedimento, se traduz num aumento da segurança e eficácia do procedimento, especialmente em doentes com obesidade, TQ prévia ou estruturas anatómicas de difícil identificação (Cheung & Napolitano, 2014).

A TQ é comummente realizada em casos de obstrução das vias aéreas superiores, DV difícil/prolongado, presença de SB abundantes ou alterações neurológicas, que comprometam a proteção da via aérea (Lipton et al., 2020). No entanto, a indicação mais frequente para a realização de TQ é a insuficiência respiratória aguda em doentes que necessitam de VMI, não sendo por isso surpreendente que as taxas de mortalidade sejam elevadas (10,8%). Contudo, estas revelam-se mais reduzidas do que as taxas dos doentes em que não foram realizadas TQ (20,6%) (Cheung & Napolitano, 2014). Quando analisadas as taxas de mortalidade, um ano após a realização da TQ, sem descanulação, o índice de mortalidade aumenta para 37% (Namin et al., 2021). Estes números expressam claramente a importância da preocupação com a descanulação, que devem ser alvo de atenção dos profissionais de saúde (Ferro et al., 2021; Zhou et al., 2022).

1.3. A traqueostomia no desmame ventilatório

Ao longo dos anos foram consideradas diferentes classificações para o DV. As publicações científicas mais recentes assumem duas classificações: a classificação *International Consensus Conference* (ICC) e a classificação *Weaning according to New Definition* (WIND). A classificação ICC continua a ser a mais aplicada e será a considerada ao longo deste estudo (Burns et al., 2021; Jeong et al., 2018; Lago et al., 2019).

A classificação ICC subdivide o DV em três grupos, consoante a dificuldade experienciada no desmame, que se encontram descritos na tabela 2 (Jeong et al., 2018).

Tabela 2: *Classificação ICC de DV*

Desmame simples	Extubação bem-sucedida, na primeira tentativa de DV.
Desmame difícil	Extubação bem-sucedida, após três tentativas ou até sete dias de DV.
Desmame prolongado	Extubação falhada, após três tentativas ou mais de sete dias de DV.

Fonte: Adaptado de Jeong et al. (2018)

Importa referir que, quando comparados às categorias "simples" e "difícil", os doentes do grupo “prolongado” têm uma expectativa de vida inferior, com taxas de mortalidade entre 14% e 32% (Bornitz et al., 2020).

A realização de TQ, como adjuvante do DV, pode facilitar esta gestão (Rhodes et al., 2012). Num estudo comparativo entre Canadá, EUA, Espanha, Argentina, Brasil, Chile, Portugal e Uruguai, Portugal era o país com maior número de dias de VMI e maior número de TQ realizadas (35%). À data da realização do estudo (27/11/1996), Portugal era o país com maior taxa de ocupação de camas de UCI, com valores a rondar aproximadamente os 100% (Esteban et al., 2000). Embora não exista acordo sobre a taxa ótima de ocupação para camas de UCI, sabe-se que o doente crítico que necessita de internamento deve tê-lo atempadamente e não deve alocado noutra área do hospital, pelo que a gestão das camas deve ser realizada nesse sentido (Tierney & Conroy, 2014).

Como já referido neste estudo, Portugal apresenta-se, tendencionalmente, como um país com um reduzido número de camas de UCI por 100000 habitantes e com taxas de ocupação elevadas (Esteban et al., 2000). Esta realidade tornou-se muito notória na fase pandémica e impulsionou grandes restruturações no Sistema Nacional de Saúde português (Ministério da Saúde, 2020).

Para tentar encurtar o DV, muitas vezes já prolongado, as equipas de saúde optam pela realização de TQ (Bösel, 2014). O processo de DV promove a possibilidade de reduzir a sedação, melhorar a comunicação, reduzir o suporte ventilatório, diminuir o espaço morto, facilitar a limpeza das vias aéreas, e participar ativamente no processo de reabilitação, reduzindo, assim, a perda de massa muscular (Barry & Bodenham, 2004; Shinn et al., 2019).

Apesar de ser uma técnica que favorece o DV, a presença prolongada de uma cânula de TQ poderá trazer consequências nefastas para o doente, tais como o

agravamento da disfagia, o desenvolvimento de granulomas e a hemorragia, devendo ser ajuizada a sua remoção, com segurança, o mais precocemente possível (Fernandez-Bussy et al., 2015). O processo de remoção da cânula de TQ é denominado de descanulação (Everitt, 2016).

Apesar da relevância da descanulação, não existe um protocolo universalmente aceite para sua execução (Santus et al., 2014). O conhecimento científico sobre a importância do EEER neste processo é igualmente escasso (Heidler et al., 2018; O'Connor & White, 2010).

Vários estudos têm refletido sobre os fatores a ter em consideração na decisão da descanulação (Ghiani et al., 2022; Kutsukutsa et al., 2019; Medeiros et al., 2019) e nos fatores preditores de sucesso da mesma (Lima et al., 2011; Rose et al., 2017; Stelfox et al., 2008), sendo, alguns destes, alvo direto de atuação do EEER.

Existe alguma falta de consenso nos indicadores que devem estar reunidos para a descanulação, nomeadamente o valor de pico de fluxo de tosse (PFT) recomendado. Bach e Saporito (1996) recomendam um valor de PFT 160 Lt/min, mas Chan *et al.* (2010) definiram um valor de PFT significativamente menor, de 29 Lt/min, como suficiente para uma descanulação bem-sucedida.

A oxigenoterapia humidificada de alto fluxo por cânulas nasais (ONAF) tem adquirido expressão como terapia adjunta no DV, uma vez que é mais confortável e efetiva do que o oxigénio frio e seco (Neiva et al., 2021; Ramachandran, 2021; Stripoli et al., 2019). Em termos fisiológicos, aumenta a FiO_2, liberta e reduz o espaço morto nas vias aéreas superiores, e cria pressão expiratória final positiva. Os seus mecanismos de ação aumentam a rentabilidade do oxigénio fornecido, amplificam os níveis de conforto do doente e reduzem o seu consumo de energia (Neiva et al., 2021; Ramachandran, 2021; Stripoli et al., 2019).

Oferecer os melhores cuidados possíveis aos doentes significa remover a VMI o mais precocemente possível, sendo que a forma mais correta de assegurar esse pressuposto é utilizar protocolos desenvolvidos especificamente para esta área (Willden, 2019). Algumas normas de orientação clínica têm efetivamente sugerido a implementação de protocolos de DV que sejam criados por uma equipa interdisciplinar e implementados por pessoal não médico, tais como enfermeiros e terapeutas respiratórios (Fan et al., 2017; Haas & Loik, 2012; MacIntyre, 2001). Haas e Loik (2012) defendem ainda que os profissionais responsáveis pela implementação desses protocolos devem ser

os que passam mais tempo junto dos doentes, e por isso os que melhor os conhecem, para que sejam minimizados os riscos, assim como atrasos desnecessários.

1.3.1. Unidades de desmame ventilatório especializado

Em alguns países, como a Alemanha e Inglaterra, existem unidades especializadas em DV (Navalesi et al., 2014). Neste sentido, é apresentado um pequeno resumo da informação consultada, na procura de compreender este fenómeno.

Nos últimos anos, o número de doentes que experienciam um DV prolongado tem aumentado e, consequentemente, o número de doentes com necessidade de realização de TQ e ventilação domiciliar também (Bornitz et al., 2020). Atualmente, estima-se que cerca de 10% dos doentes críticos necessitem de VMI prolongada, o que representa um aumento considerável do número de dias de internamento, dos custos e das taxas de mortalidade (Esquinas, 2016; Lone & Walsh, 2011). De facto, apenas 50% dos doentes que têm alta hospitalar dependentes de ventilação sobrevivem e com drásticas reduções nos níveis de qualidade de vida (Kahn, 2010). De salientar que estes doentes apresentam uma elevada recorrência aos serviços de urgência, com elevada probabilidade de reinternamento hospitalar, sendo que um número significativo dos mesmos tem alta da UCI com cânulas de TQ (Hill et al., 2017).

Verifica-se, igualmente, que as taxas de mortalidade são mais elevadas para doentes que não são descanulados em ambiente de UCI. Em 2020, num estudo de prevalência realizado em 30 unidades de cuidados continuados portuguesas, existiam 33 doentes com ventilação através de TQ e desses apenas 4 se encontravam a realizar treinos de oclusão da mesma (Pereira et al., 2020). Os custos com os cuidados domiciliários deste tipo de doentes são elevados e a assistência é, muitas vezes, assegurada por equipas da comunidade, sem experiência no atendimento a doentes ventilados ou traqueostomizados (Lehmann et al., 2019; Stieglitz & Randerath, 2012; Windisch et al., 2010).

Paralelamente à questão ventilatória, é amplamente descrito na literatura que doentes que experienciam um DV prolongado e um internamento prolongado, adquirem um *status* de miopatia de desuso (Gosselink & Langer, 2016; Tobin, 2010), que é caracterizado por uma diminuição da força de forma generalizada, que muitas vezes se traduz numa tetraparésia, com um franco enfraquecimento dos músculos respiratórios, incluindo o diafragma (Fazzini et al., 2023; Lad et al., 2020). Esta condição surge como

consequência de disfunção multiorgânica, quadros sépticos, fármacos (como corticoterapia prolongada), distúrbios metabólicos, entre outros (Navalesi et al., 2014). Estes doentes representam, por isso, um dilema social e económico, com repercussões comunitárias e familiares profundas.

Com o objetivo de tentar dar uma resposta eficaz a esta situação, surgem as unidades de DV, na década de 80, do século XX (Navalesi et al., 2014). Estas unidades destinam-se a doentes cronicamente ventilados, traqueostomizados, mas hemodinamicamente estáveis, e visam um processo de reabilitação intensiva com enfoque no sucesso do DV e consequente descanulação (Navalesi et al., 2014). Assim, as unidades de DV especializado caracterizam-se por realizarem uma abordagem interdisciplinar com enfermagem de reabilitação, fisiatria, fisioterapia, terapia da fala, terapia ocupacional, em presença constante. Contam ainda com apoio de nutricionista, psicólogo e assistente social, se necessário (Navalesi et al., 2014).

Segundo Magnet *et al.* (2018), um DV estruturado poderá ser facilitador de um processo bem-sucedido para doentes que experienciam um desmame prolongado. Neste sentido, estas unidades desenvolvem um processo de reabilitação meticulosamente planeado e intensivo, que visa recuperar inúmeras lesões (tabela 3). Segundo a literatura consultada, estas unidades têm taxas de sucesso entre 60 e 78,2%, com internamentos que rondam os 21 a 30 dias. Cerca de 40% dos doentes malsucedidos no DV alcançam a alta para o domicílio, com suporte de VNI noturna (Davies et al., 2017; Mifsud Bonnici et al., 2016).

Tabela 3: *Consequências de um DV prolongado*

Lesões neuromusculares	• Fraqueza muscular adquirida nos cuidados intensivos; • Polineuromiopatia da doença crítica; • Mononeuropatias compressivas.
Lesões osteoarticulares	• Atrofia muscular; • Contracturas artrogénicas e/ou miogénicas; • Desmineralização óssea; • Ossificação heterotópica.
Lesões cutâneas	• Úlceras de pressão.
Lesões secundárias aos dispositivos médicos que asseguraram a via aérea artificial	• Disfunção glótica com disfagia e/ou disfonia; • Traqueomalácia.
Descondicionamento central e periférico	• Cardiopulmonar e neuromuscular.
Sequelas psico-emocionais	• Estado confusional; • Deterioração cognitiva; • Ansiedade e/ou depressão; • Disfunção sexual; • Alterações do padrão do sono.
Sequelas funcionais	• Perda de autonomia; • Dependência nas AVD.

Fonte: Adaptado de Vaz (2021)

1.4. O papel da enfermagem de reabilitação na descanulação

A idade avançada, o suporte prolongado de VMI e a fraqueza muscular têm sido descritos como como fatores de risco para o insucesso da descanulação (Choate et al., 2009; Lima et al., 2011).

Vários estudos têm descrito que a existência de uma equipa interdisciplinar na preparação e tomada de decisão na descanulação está associada a um maior sucesso do procedimento, entre eles o enfermeiro (Gundogdu et al., 2017; Mah et al., 2017; Thomas et al., 2017; Welton et al., 2016). De facto, a reabilitação precoce é descrita como determinante de sucesso no DV e na descanulação (Costi et al., 2022; Jin et al., 2021; MacIntyre, 2019; Rose et al., 2017; Zivi et al., 2018). Nas UCI's, o EEER assume um importante papel no processo de DV e, por conseguinte, na descanulação (Jin et al., 2021;

Outeiro & Soares, 2021), uma vez que a sua intervenção reduz o tempo de ventilação e aumenta a força muscular do doente crítico (Barros et al., 2022).

A evidência descreve que as habilidades e o conhecimento dos terapeutas respiratórios são essenciais para a gestão das vias aéreas, desde a VMI até à descanulação. Prasad *et al.* (2010) descrevem no seu estudo, que o terapeuta respiratório foi identificado como sendo o principal impulsionador do desenvolvimento e implementação de protocolos em 90% das UCI's estudadas. A experiência com o desmame da VMI pode assumir um papel importante na decisão da descanulação (Christopher, 2005). Por conseguinte, defende-se que estes profissionais devem ser de eleição para a implementação de protocolos de descanulação, que sejam fomentados em orientações com base científica sólida (Christopher, 2005). De facto, os protocolos de desmame da VMI desenvolvidos e aplicados por enfermeiros e terapeutas respiratórios são seguros e conduzem a extubações bem-sucedidas e mais céleres do que as orientadas pela classe médica (Kollef et al., 1997). Nesse sentido, o terapeuta respiratório, tendo em consideração a abordagem interdisciplinar efetuada ao doente, deve desenvolver um estudo científico sobre as abordagens atuais para a descanulação, o que melhorará a qualidade dos cuidados prestados e dos resultados obtidos (Christopher, 2005). Em Portugal, o papel do terapeuta respiratório é desempenhado pelo EEER.

As *guidelines* relacionadas com o DV e a descanulação recomendam, igualmente, que os doentes sejam sujeitos a uma reabilitação física precoce, uma vez que a mobilização precoce diminui o tempo de VMI e promove a recuperação de funções, nomeadamente a capacidade para caminhar (Fan et al., 2017). Lee *et al.* (2015) relatam que a mobilização precoce do doente crítico é segura, desde que com monitorização cuidadosa.

Carson (2012) refere que a reabilitação agressiva é um marco importantíssimo na recuperação do doente crítico, sendo que os doentes, ainda ventilados, devem ser mobilizados precocemente e de forma intensiva. Jolley *et al*. (2014) demonstram uma opinião muito semelhante à de Carson (2012), descrevendo que os doentes de UCI têm pouca prescrição de mobilização e, muitas vezes, de baixa intensidade. No entanto, a mobilização excessivamente agressiva pode interferir no DV de forma negativa, pelo que deve existir uma avaliação dos doentes com ajuste da prescrição de exercício adequado.

Existem várias guidelines e protocolos publicados sobre o DV, mas pouco consenso no que concerne ao desmame do doente com TQ e descanulação, embora se verifique alguma preocupação com a descanulação num ambiente externo à UCI, como o

estudo de Blondonnet *et al*. (2014) em várias unidades hospitalares francesas sugerem. Vários estudos parecem confirmar um aumento da mortalidade, nos doentes que são descanulados em enfermaria, após alta da UCI (Fernandez et al., 2008; Fernandez-Bussy et al., 2015).

Em suma, a evidência sugere que os doentes com TQ devem ser acompanhados por um terapeuta respiratório e enfermeiro, com auxílio de protocolos, reabilitação precoce e intensiva, devendo ser descanulados ainda em UCI.

1.5. Enfermagem de Reabilitação – Perspetiva mundial/dificuldades sentidas

Uma das dificuldades sentidas no desenvolvimento deste estudo, prende-se com a dificuldade em encontrar evidência sobre a temática em análise. Face à dificuldade sentida, sentimos necessidade de ampliar a pesquisa, para evidência publicada ou produzida por outros grupos profissionais, que desenvolvam a sua área de atuação no processo de reabilitação, na qual se incluam grupos ou subgrupos, alvo de análise, de intervenções comuns aos EEER.

A Organização Mundial de Saúde (OMS) define que a reabilitação é um dos elementos da *Cobertura Universal de Saúde*, o que significa que a intervenção das equipas de reabilitação deve estar mundialmente disponível para as pessoas, nas diversas fases do seu ciclo vital (World Health Organization, 2023). Assim, a reabilitação não deve ser disponibilizada apenas no período de pós doença, mas em todos os setores de prestação de cuidados de saúde, inclusivamente nos cuidados à comunidade, tendo em consideração uma perspetiva preventiva (Rethnam et al., 2022). É ainda importante reforçar globalmente os serviços de reabilitação relacionados com a saúde, uma vez que apenas alguns doentes que beneficiariam de reabilitação a recebem atempadamente (Kamenov et al., 2019).

A qualidade da reabilitação disponibilizada à população pode exponenciar a sua qualidade de vida (Nithiatthawanon et al., 2021), nomeadamente através da diminuição da ansiedade e do aumento do bem-estar emocional e funcionalidade geral, bem como da força muscular e da resistência (Aboagye et al., 2015; Fulop et al., 2021). Além disso, a reabilitação contribui para a redução dos custos associado aos cuidados de saúde (Kaye et al., 2020; Le Danseur et al., 2019; Nithiatthawanon et al., 2021).

Nesse sentido, a enfermagem de reabilitação desempenha um papel crucial na abordagem do doente em todas as fases do seu ciclo vital, que inclui a compreensão do processo de reabilitação e o desenvolvimento de competências que permitam capacitar os alvos dos cuidados a alcançar independência e funcionalidade (Gutenbrunner et al., 2022). Apesar disto, o papel da enfermagem na reabilitação subsiste impercetível e menosprezado (Larsen, 2020), relacionando-se, também, com a necessidade de produzir conhecimento científico na área (Gutenbrunner et al., 2022).

De facto, são ainda poucos os países com enfermeiros especializados na área da reabilitação: Austrália, Canadá, EUA, França, Guatemala, Inglaterra, México, Holanda, Nova Zelândia, Portugal, Rússia, Seychelles e Suíça (Schoeller et al., 2018). Na busca pela legislação que regule a intervenção do enfermeiro de reabilitação nestes países, denota-se que poucos concretizam a reabilitação como área específica do conhecimento e atuação profissional e, ainda menos, os que legislam conceitos como formação, atuação e objetivos específicos neste domínio (Schoeller et al., 2018).

A criação desta especialidade de Enfermagem encontra-se intimamente relacionada com eventos bélicos mundiais e a recuperação dos seus soldados e população, especialmente os mais jovens, que teriam ainda potencial para serem elementos ativos e produtivos na sociedade (Andrews, 1981; Barnitt & Pomeroy, 1995; Blaxter, 1976; Pryor et al., 2009; St-Germain, 2014). Mundialmente, a nomenclatura utilizada e as atribuições específicas para esta especialidade são diferentes. Por exemplo, em Inglaterra e na Austrália, o termo empregue para definir enfermagem de reabilitação é *Disability Nursing* (Schoeller et al., 2018), o que não se coaduna com as recomendações do OMS e parece não incluir doentes crónicos ou a intervenção de reabilitação ao nível da prevenção.

A regulamentação da Enfermagem de Reabilitação ocorreu, numa sequência cronológica, em Inglaterra (1950), Portugal (1960), EUA (1970) e Austrália (1990). Os restantes países regulamentaram esta especialidade posteriormente a 2000 ou em data desconhecida. Reconhece-se, por isso, o percurso relativamente recente, ou inexistente, desta área de especialidade (Schoeller et al., 2018).

Nos locais onde é reconhecida a intervenção especializada do EEER, assume-se que estes profissionais têm uma atuação assente no cuidar da pessoa, na sua promoção e proteção, e na sua recuperação e reabilitação (Schoeller et al., 2018), e, como tal, requerem uma formação acrescida, para decretar a legalidade do exercício profissional (Schoeller et al., 2018). Mundialmente, os EEER atuam em diversos contextos: hospitais, centros de reabilitação, clínicas, cuidados domiciliares, cuidados paliativos e serviços

comunitários. De facto, os EEER desempenham um papel importante na coordenação dos cuidados, na gestão de casos, na educação do doente e na prestação de cuidados especializados durante o processo de reabilitação, avaliação, planeamento e implementação de intervenções de reabilitação, além de oferecer apoio emocional e educacional ao doente e família/cuidador (Regulamento n.º 392/2019: Competências Específicas Do Enfermeiro Especialista Em Enfermagem de Reabilitação, 2019). Além disso, desempenham ainda um papel fulcral na promoção da autonomia do doente, no ensino e treino do autocuidado e no fornecimento de suporte durante o processo de reabilitação (Association of Rehabilitation Nursing, 2015; Schoeller et al., 2018). Segundo Gutenbrunner *et al.* (2022), é imprescindível que no desenvolvimento de programas de reabilitação estejam envolvidos enfermeiros com competências específicas nesta área.

Assim, as funções do enfermeiro de reabilitação podem variar de acordo com o país e o sistema de saúde específico. No entanto, em alguns países, na inexistência ou escassez de EEER, algumas funções podem ser asseguradas por outros profissionais de saúde. É importante ressalvar que a organização e a divisão de responsabilidades entre profissionais de saúde podem diferir, significativamente, em diferentes contextos mundiais (Havrilla, 2017; Vaughn et al., 2016).

Torna-se igualmente fundamental ressalvar que, na abordagem interdisciplinar da reabilitação, é reconhecida a colaboração entre profissionais de saúde de diferentes áreas (Vaughn et al., 2016). No entanto, embora certas funções possam ser atribuídas a outras classes profissionais, a enfermagem de reabilitação desempenha um papel essencial na coordenação dos cuidados, na avaliação holística do doente, na promoção do autocuidado, na educação e na prestação de cuidados de enfermagem especializados, que se estendem para além do âmbito de outras profissões (Havrilla, 2017).

A literatura relata quatro grandes domínios de atuação da enfermagem de reabilitação, na fase aguda de doença: promoção da saúde e estilos de vida saudáveis, vigilância das práticas de enfermagem, liderança e cuidados interprofissionais (Havrilla, 2017; Vaughn et al., 2016). Uma vez que nas UCI's se prestam cuidados em fase aguda, a enfermagem de reabilitação, neste contexto, contribui para proteger e potenciar as funções básicas do organismo, tais como a respiração, as funções cardiovasculares, as funções da pele e as funções neuromusculares. Estes profissionais asseguram, também, cuidados complementares de nutrição (incluindo o rastreio e apoio ao tratamento da

disfagia). O EEER promove, ainda, a mobilização precoce e o treino do autocuidado (Gutenbrunner et al., 2022).

Face ao exposto, compreende-se então que é primordial que se consolide a presença da enfermagem de reabilitação nas equipas responsáveis pela recuperação dos doentes, nos variados contextos, no sentido de serem assegurados cuidados de excelência e atingidos os melhores resultados (Gutenbrunner et al., 2022; World Health Organization, 2021). Gutenbrunner et al. (2022) sugerem que os órgãos de gestão devem ter esta informação em consideração, no sentido de prever a atuação de enfermagem no processo de reabilitação dos doentes, uma vez que inúmeros aspetos necessitam ser revistos e potenciados com o objetivo de corroborar o papel da enfermagem na reabilitação, melhorando assim os resultados alcançados. De facto, torna-se emergente a adoção de algumas medidas que estão relacionadas com a integração plena dos enfermeiros nas equipas de reabilitação, com a visibilidade e reconhecimento devidos (Gutenbrunner et al., 2022). Nesse sentido, deve ser desenvolvida formação especializada que inclua a compreensão profunda do papel da reabilitação na melhoria da funcionalidade, bem como das intervenções que conduzem ao seu alcance, ao mesmo tempo que deverá ser potenciado o desenvolvimento de competências académicas, com disponibilização de financiamento para a concretização de estudos científicos, que permitam não só a expansibilidade da prática baseada na evidência em enfermagem de reabilitação, bem como a aquisição de equipamento técnico adequado (Gutenbrunner et al., 2022). No sentido de facilitar este processo, a formação pós-graduada para enfermagem de reabilitação deveria então ser determinada a nível mundial (Gutenbrunner et al., 2022).

2. ENQUADRAMENTO METODOLÓGICO

A investigação constitui uma competência do enfermeiro especialista, no domínio do desenvolvimento das aprendizagens profissionais, quando "Identifica lacunas do conhecimento e oportunidades relevantes de investigação" e "Investiga e colabora em estudos de investigação" (Regulamento n.º 140/2019: Competências Comuns Do Enfermeiro Especialista, 2019). Nesse sentido, o presente capítulo pretende descrever a metodologia utilizada na elaboração desta dissertação de mestrado: *scoping review*. Porém, uma vez que a mesma irá ser descrita de forma mais pormenorizada no capítulo 3 (artigo I) e no capítulo 4 (artigo II), optamos por neste capítulo não a apresentarmos de forma tão expansiva.

Uma das formas de contribuir para a produção de conhecimento científico relevante para a prática clínica são os estudos de revisão, no qual se enquadra a *scoping review*. Este tipo de estudo constitui uma metodologia de investigação que possibilita pesquisar áreas emergentes do conhecimento, ainda pouco investigadas, assim como aumentar o conhecimento atual (Munn et al., 2022). A *scoping review* é considerada uma metodologia rigorosa para fornecer uma visão geral sobre o estado das evidências científicas em temas emergentes, sendo especialmente profícua no esclarecimento de conceitos e tópicos de investigação, na identificação de lacunas e no estabelecimento de questões para investigações futuras (Peters et al., 2022). Os principais objetivos da elaboração de uma revisão do tipo *scoping* são explorar a amplitude e/ou extensão da literatura existente, mapear e resumir as evidências numa determinada temática, bem como informar sobre pesquisas futuras relevantes (Tricco et al., 2016). Este tipo de revisão também é recomendado como processo precursor de uma revisão sistemática, para nomear os tipos de evidências disponíveis num campo específico de investigação, para possibilitar a identificação e a análise de lacunas no conhecimento, para esclarecer conceitos/definições na literatura, para analisar como a pesquisa é conduzida em determinado tópico ou campo de investigação e para identificar as principais características ou fatores relacionados a um conceito (Munn et al., 2022).

Por forma a conduzir um processo transparente e de fácil interpretação, surgiram protocolos orientadores para este tipo de investigação. O desenvolvimento de diretrizes, sob a forma de protocolo, pode auxiliar o investigador a melhorar não só a conduta de pesquisa, como a própria elaboração do relatório de síntese, permitindo, desta forma, que o consumidor da informação produzida compreenda, claramente, o processo desenvolvido na realização do processo investigativo (Tong et al., 2012). Nesse sentido,

a presente dissertação teve como base de organização o protocolo da JBI® (Francis, 2022).

3. ARTIGO I:

THE INTERVENTION OF REHABILITATION NURSE IN PROMOTING EFFICIENT DECANNULATION OF CRITICALLY ILL PATIENTS: SCOPING REVIEW PROTOCOL

SERVIR, n.º(vol), página inicial-página final

A intervenção do enfermeiro de reabilitação na descanulação eficiente do doente crítico: Protocolo de *scoping review*

The intervention of rehabilitation nurse in promoting efficient decannulation of critically ill patients: Scoping review protocol

La intervención de la enfermera de rehabilitación en la decanulación eficiente del paciente crítico: Protocolo de revisión del alcance

RESUMO

Introdução: A ventilação mecânica prolongada está associada a dificuldade de desmame ventilatório e é considerada indicação de traqueostomia em cuidados intensivos. A ventilação prolongada traz inúmeras complicações e, como a traqueostomia não pode ser considerada inofensiva, é imprescindível que a descanulação seja realizada o mais rápido possível. A descanulação eficiente deve ter uma abordagem interdisciplinar e o enfermeiro de reabilitação pode assumir um papel preponderante.

Objetivo: Mapear as evidências disponíveis sobre a intervenção de reabilitação na descanulação do doente crítico.

Métodos: Esta *scoping review* seguirá a estratégia PCC e as recomendações *PRISMA*® do *Joanna Briggs Institute*®. Pretendemos responder à questão: "Qual a intervenção do enfermeiro especialista em enfermagem de reabilitação para uma descanulação eficiente nos doentes traqueostomizados em cuidados intensivos?". A pesquisa será realizada nas bases de dados MEDLINE, CINAHL® Complete, Cochrane Database of Systematic Reviews, MedicLatina, Nursing & Allied Health Collection, Scopus®, Web of Science, ProQuest, RCAPP, OpenGrey, MedNar e Google Scholar. Dois revisores independentes avaliarão os resultados obtidos, com recurso a um terceiro revisor caso existam divergências.

Conclusão: Espera-se que esta revisão forneça informação para a criação de um protocolo que oriente a tomada de decisão de reabilitação, na descanulação.

Palavras-chave: "Enfermagem";"Reabilitação";"Traqueostomia";"ICU"

ABSTRACT

Introduction: Prolonged mechanical ventilation is associated with difficult ventilatory weaning and considered an indication for tracheostomy in intensive care. Prolonged ventilation has numerous complications and, since tracheostomy cannot be considered harmless, it is imperative that decannulation is performed as quickly as possible. Efficient decannulation must have an interdisciplinary approach, and the rehabilitation nurse can assume a significant role.

Objective: To map the available evidence on the intervention of rehabilitation in decannulation of critically ill patients.

Methods: This scoping review will follow the PCC strategy and the PRISMA® recommendations by Joanna Briggs Institute®. We intend to answer the question: "What is the intervention of the specialist nurse in rehabilitation for efficient decannulation in tracheostomized patients, in intensive care?". The search will be performed in MEDLINE, CINAHL® Complete, Cochrane Database of Systematic Reviews, MedicLatina, Nursing & Allied Health Collection, Scopus®, Web of Science, ProQuest, RCAPP, OpenGrey, MedNar and Google Scholar databases. Two independent reviewers will evaluate the obtained results, resorting to a third reviewer in case of divergences.

Conclusion: It is expected that this review will provide information for the creation of a protocol, which guides the decision making of rehabilitation nursing in decannulation.

Keywords: Nursing";"Rehabilitation";"Tracheostomy";"ICU"

RESUMEN

Introducción: La ventilación mecánica prolongada se asocia a destete ventilatorio difícil y se considera indicación de traqueotomía en cuidados intensivos. La ventilación prolongada tiene numerosas complicaciones y, dado que la traqueotomía no puede considerarse inofensiva, es imprescindible que la decanulación se realice lo antes posible. La decanulación eficiente debe tener un enfoque interdisciplinario, y la enfermera de rehabilitación puede asumir un papel importante.

Objetivo: Mapear la evidencia disponible sobre la intervención de rehabilitación en la decanulación de pacientes críticos.

Métodos: Esta revisión de alcance seguirá la estrategia PCC y las recomendaciones PRISMA® del Joanna Briggs Institute®. Pretendemos responder a la pregunta: "Cuál es la intervención de la enfermera especialista en enfermería rehabilitadora para la decanulación eficiente en pacientes traqueostomizados en cuidados intensivos?". La búsqueda se realizará en las bases de datos MEDLINE, CINAHL® Complete, Cochrane Database of Systematic Reviews, MedicLatina, Nursing & Allied Health Collection, Scopus®, Web of Science, ProQuest, RCAPP, OpenGrey, MedNar y Google Scholar. Dos revisores independientes evaluarán los resultados obtenidos, recurriendo a un tercer revisor en caso de divergencias.

Conclusión Se espera que esta revisión proporcione información para la creación de un protocolo, que oriente la toma de decisiones de rehabilitación en la decanulación.

Palabras clave: Enfermería";"Rehabilitación";"Traqueotomía";"UCI"

Introduction

Mechanical ventilation is one of the therapies used in life support when there is ventilatory failure or inability to promote it. The process of releasing the patient from invasive artificial ventilation (ventilation weaning) is not always a simple procedure, and sometimes become a difficult ventilatory weaning (Burns et al., 2021). The prolonged use of a tracheal intubation can cause numerous complications: oral mucosa injury, vocal cords damage, tracheal stenosis or dilation, respiratory infections, muscle loss (including respiratory muscles), increased length of stay and hospital costs, and increased morbidity and mortality (Touman & Stratakos, 2018). To minimize these events and optimize the ventilatory weaning, a tracheostomy (TQ) is sometimes performed (Ghattas et al., 2021; Medeiros et al., 2019; Raimondi et al., 2017).

The prolonged presence of a TQ tube may have negative consequences for patients: dysphagia worsening, granulomas development and hemorrhage (Fernandez-Bussy et al., 2015). Therefore, cannulas should be removed as soon as possible. The existence of an interdisciplinary team, including nurses, in the preparation and decision-making of decannulation is associated with a greater success of the procedure (Gundogdu et al., 2017; Thomas et al., 2017a). Evidence suggests that early mobilization and rehabilitation is crucial for successful ventilator weaning and decannulation (Costi et al., 2022a; Jin et al., 2021; MacIntyre, 2019). In Intensive Care Units (ICUs), nurses are important in the ventilatory weaning process and, therefore, in decannulation (Jin et al., 2021; Outeiro & Soares, 2021).

An initial search was performed on International Prospective Register of Systematic Reviews (PROSPERO), *Joanna Briggs Institute* (JBI) and Open Science Framework (OSF) and no reviews were found on the subject, in progress or already developed.

The main objective of this review is to map and analyze the available evidence on the intervention of rehabilitation in decannulation of critically ill patients. The information found aims the development of a protocol that supports the rehabilitation intervention during decannulation.

For this purpose, the following research question was formulated:

In tracheostomized patients, admitted in ICU, what is(are) the rehabilitation intervention(s) that promote successful decannulation?

This question was developed using the vocabulary found in a preambular research.

1. Theoretical Framework

Weaning from Mechanical Ventilation is an interdisciplinary concern in critically ill care. Whenever it is prolonged, costs and risk of complications increase (Beduneau et al., 2017).

TQ is a surgical procedure that involves placing a tube into patient's trachea. It is considered one of the oldest surgical procedures ever described (Mehta & Mehta, 2017), which gained expression in ICUs, in 1950, during the polio epidemic (Mehta & Mehta, 2017). Later, Ciaglia (1985) developed a derivation to the surgical technique, performing a percutaneous TQ. Over the past few years, this technique has undergone changes and improvements (Mehta & Mehta, 2017). Surgical TQ refers to the placement of a tracheal cannula, after dissection of

pre-tracheal tissues and incision in the tracheal wall, while percutaneous TQ involves blunt dissection of the pre-tracheal tissue, followed by dilation using a guidewire, and insertion of a tracheal cannula, using the Seldinger technique (Raimondi et al., 2017). This procedure, in critically ill patients, associated with ventilator weaning, promotes sedation weaning, communication improvement, a gradual decrease in ventilatory support, a better airway clearance and active participation in the rehabilitation process through the increase of autonomous breathing work, which enables a minor loss of muscle mass (Shinn et al., 2019).

The process of weaning the tracheostomized patient to a state of spontaneous breathing through the upper airways, with removal of the cannula, is called decannulation. This simple procedure requires almost perfect coordination of the brain, swallowing, coughing, phonation and use of respiratory muscles (Singh et al., 2017a).

The need to maintain a TQ should be assessed daily. Decannulation should be performed as soon as possible (Mehta & Mehta, 2017).

A study carried out in 2022, with a sample of 917 patients, reveals that only 40.8% of the population was decannulated 3 months after performing the TQ. It took 12 months to decannulate 63.9% and 24 months to decannulate 65%. Decannulation rates increased rapidly up to 3 months but plateaued after 12 months (Ishizaki et al., 2022). This study reinforces the importance of early intervention in tracheostomized patients, ventilatory weaning and subsequent decannulation.

There are several methods described in the literature to proceed with decannulation (Mehta & Mehta, 2017).

Many of the described methods involve the implementation of weaning/decannulation protocols. Despite the relevance and importance of this process, there is no universally accepted protocol for its implementation (Singh et al., 2017a).

Evidence on the role of the specialist nurse in rehabilitation nursing is also scarce.

One of the 2001 guidelines, for ventilator weaning, relates to the importance of creating weaning protocols, designed to be implemented in the ICU by non-medical health professionals (respiratory therapists and nurses). According to the authors, there is clear evidence that these professionals can execute protocols and improve clinical results, reducing costs with the treatment of critically ill patients (MacIntyre, 2001).

2. Methods

The protocol of this scoping review is registered in Open Science Framework with the following DOI: 10.17605/OSF.IO/SDBXH.

This review will be conducted in accordance with the JBI® methodology for scoping reviews (Peters et al., 2022) and will consider experimental and quasi-experimental studies, including randomized controlled trials, non-randomized controlled trials, before- after studies, and interrupted time series studies, analytical observational studies, including prospective and retrospective cohort studies, case-control, analytical cross- sectional, descriptive observational, including case series, individual case reports and cross-sectional descriptive studies. Qualitative studies will also be included, including but not limited to designs such as

qualitative description and action research. Systematic reviews that meet the inclusion criteria will also be included.

SEARCH STRATEGY: A preliminary search was performed, limited to Medline via PubMed and CINAHL (Cumulative Index to Nursing and Allied Health Literature) via EBSCOhost, to identify evidence on the topic of decannulation. In the analysis of the vocabulary present in titles, abstracts, and keywords, used to describe the subject under study, was carried out. The search strategy of this review aims to map published and unpublished evidence. Therefore, controlled vocabulary such as MeSH (Medical Subject Headings)/DECS (Descriptors in Health Sciences) and keywords in natural language will be included. A language-related search filter will be applied and evidence in Portuguese, English, French and Spanish will be selected. No time limitation will be considered. We will review the reference lists of selected evidence for additional sources of information and evaluate the full text according to the inclusion criteria. The databases to be consulted will be MEDLINE via PubMed, CINAHL via EBSCOhost, Cochrane Database of Systematic Reviews, MedicLatina and Nursing & Allied Health Collection, Web of Science and Scopus. We will include a search for grey literature and unpublished material in scientific repositories, such as RCAAP, OpenGrey, ProQuest, Mednar and Google Scholar. A summary of the research strategy can be found in Table 1.

Table 1*: Scoping Review* 's Research Strategy

	Scoping Review 's Research Strategy
1	Introductory search without identifying a *scoping review* on the topic: Decannulation of critical ill patients after difficult/prolonged ventilatory weaning
2	Identification of the most used and appropriate words/ indexing terms for the selected databases – MeSH/ DeCS terms and NCBI: MeSH database.
3	Construction of the boolean expression.
4	Search in two recommended databases: MEDLINE (via PubMed) and CINAHL (via EBSCOhost).
5	Analysis of words/indexing terms present in the titles and abstracts of the obtained evidence.
6	Search in other databases, applying the respective boolean expression.
7	Gray literature search.
8	Exportation of the evidence to EndNote® online with WoS version (Clarivate Analytics, US) reference management software.
9	Checking and removing duplicate literature.
10	Application of inclusion criteria: articles in Portuguese, English, Spanish and French.
11	Analysis of evidence according to title and abstract by two independent reviewers.
12	Analysis of evidence according to the full text by two independent reviewers.
13	If there are disagreements in the evidence selection, the third independent reviewer will be consulted.
14	Analysis of references from the selected evidence in the full text reading stage.
15	Data extraction and analysis according to the form developed by the reviewers.

16	Presentation of the obtained data.

Source: Adapted from Peters et al. (2020).

STUDY SELECTION: The results will be managed in EndNote® online with WoS version (Clarivate Analytics, US). Prior to the selection of the evidence found with the search strategy, the duplicated literature will be eliminated. The titles and abstracts will be evaluated by two independent reviewers, according to the inclusion criteria. Potentially relevant sources will be retrieved in full-text and their citation details will be transcribed into a data extraction table (Table 2). During this process, the differences found between the two reviewers will be managed through discussion and a third reviewer can be consulted, if necessary. The final report not only will incorporate the reasons for excluding full-text sources of evidence that do not meet the inclusion criteria, but it also will include the PRISMA-ScR diagram (Preferred Reporting Items for Systematic Reviews and Meta-Analyses"extension for Scoping Reviews") and the description of all process (Tricco et al., 2018).

Table 2. Data Extraction Tool

DATA EXTRACTION TOOL	
AUTHOR(S)	
PUBLICATION YEAR	
PLACE OF PUBLICATION/ JOURNAL	
COUNTRY OF ORIGIN/ PUBLICATION	
PURPOSE OF THE STUDY/ RESEARCH QUESTION	
POPULATION SIZE/ RECRUITMENT CONTEXT	
METHODOLOGY/ TYPE OF STUDY	
REHABILITATION INTERVENTION (WEANING PROCEDURE; EVALUATION AND MONITORING)	
RESULTS	
MAIN CONCLUSIONS	
COMMENTS	

Source: Prepared by the author (2022)

DATA EXTRACTION: Data will be extracted by using an instrument developed for this purpose, which includes relevant information to the review question, such as details about the participants, concept, context, methodology adopted and key findings. An outline of the data extraction instrument can be found in Table 2. The preliminar data extraction instrument will be modified and revised, if necessary, during the data extraction process, and the changes will be explained in the final review. Any diferences found between the two reviewers will be managed through discussion or with a third reviewer for a tiebreak. If appropriate, article authors will be contacted to request missing or additional data.

DATA ANALYSIS AND PRESENTATION: This scoping review will gather the evidence found using a descriptive summary and content analysis. The descriptive summary will describe the characteristics of the included studies (study design, year of publication, characteristics of the study populations and geographic location) and will be presented in a table form. Content analysis will be presented in narrative form and will highlight the rehabilitation nurse interventions in decannulation of critically ill patients, in order to describe and clarify the findings of the review in this context. Guidelines for future research will also be presented.

2.1 Participants

This scoping review will consider studies that include critically ill patients, aged over 18 years, whose tracheostomy was performed in the context of difficult or prolonged ventilatory weaning and who have undergone rehabilitation. Critical patients are those whose survival is dependent on advanced means of monitoring and therapy, caused by failure or dysfunction of one or more organs (Vincent & Creteur, 2019). Regardless their physical or geographic characteristics, all critically ill patients have severe organ dysfunctions (or risk of developing it) require ICU admission and must be cared by experienced intensivists (Vincent & Creteur, 2019).

Ventilatory weaning is a complex process, which can be described as the translation from mechanical to spontaneous ventilation. Two ventilatory weaning classification systems are frequently used in ICUs, the WIND system (Weaning according to a New Definition) or the ICC (International Consensus Conference) (Jeong et al., 2018). Given the small number of publications with the WIND classification, this study will consider the ICC classification to describe weaning groups. It is important, for this study, to clarify the definitions of difficult and prolonged weaning. According to the ICC classification, difficult weaning is considered the one that is successful after more than one day of trying, but not more than one week. Prolonged weaning is the one that doesn´t end seven days after the first attempt (Beduneau et al., 2017).

The World Health Organization (2021) defines rehabilitation as a bundle of interventions that are applied to individuals that have limitations in their health condition, with the aim of reducing disability and optimizing their function.

Considering that this review aims to support the development of a protocol for decannulation of critically ill adults, studies in the pediatric population (age less than 18 years) will be excluded. Studies whose patients have undergone a tracheostomy procedure due to surgery (scheduled or not) in the context of maxillofacial or otorhinolaryngological pathology will also be excluded. These patients are decannulated at the joint recommendation of the ICU team

and the surgeon, due to the type of surgery, the purpose of the tracheostomy tube in the recovery from the surgical procedure and the presence/absence of edema or scar tissue (Littlewood et al., 2021).

2.2 Concept

The main concept of interest is decannulation.

Decannulation is a process of removing a tracheostomy tube (Everitt, 2016). This process is considered one of the steps in weaning from mechanical to spontaneous ventilation (Singh et al., 2017a).

2.3 Context

This review will include patients admitted in a level three ICU.

The literature describes intensive care as interventions provided to patients who are at risk of life or in a foreseeable situation, with a similar outcome. The ICU is the physical location where this care is organized and provided. This units provide complex and advanced monitoring systems, to promote organ support and treatment to those patients. Therefore, the decision to admit a patient in the ICU is complex and multidisciplinary (Jackson & Cairns, 2021). ICUs can be divided by levels of care. This review will consider level three ICUs: where patients can be provided with invasive mechanical ventilation. The literature describes level three ICUs as units with resources for admitting patients who need multiorgan support, advanced monitoring techniques and at least one intensive care nurse dedicated to each client, in order to provide adequate care at the respiratory (invasive or non-invasive ventilation and extracorporeal membrane oxygenation-ECMO), cardiovascular, renal, or neurological system (Jackson & Cairns, 2021).

Conclusion

With the development of this review, we hope to organize the evidence available on the subject for the subsequent elaboration of a guiding protocol for rehabilitation actions in the decannulation process.

Conflict of Interests

There is no conflict of interest in this project.

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4. ARTIGO II:

THE INTERVENTION OF REHABILITATION NURSE IN PROMOTING EFFICIENT DECANNULATION OF CRITICALLY ILL PATIENTS: SCOPING REVIEW

THE INTERVENTION OF REHABILITATION NURSE IN PROMOTING EFFICIENT DECANNULATION OF CRITICALLY ILL PATIENTS: SCOPING REVIEW

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Abstract

Objective: To map and analyze the available evidence on the intervention of rehabilitation in decannulation of critically ill patients. The main goal is the development of a protocol that supports the rehabilitation intervention during decannulation.
Introduction: Decannulation is a complex process for which there is no universally accepted procedure. Although the rehabilitation importance in this process, there is a lack in the evidence about the role of specialist nurses in rehabilitation.
Inclusion criteria: Articles and documents with patients over 18 years old, submitted to tracheostomy, hospitalized in Intensive Care Units, level III, published in Portuguese, English, Spanish and French were included. Studies with patients whose tracheostomy was performed in the context of maxillofacial or otorhinolaryngological surgery were excluded.
Methods: This scoping review followed the Joanna Briggs Institute® and Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews® (PRISMA-ScR®) recommendations. Search was performed in MEDLINE, CINAHL®, Cochrane Database of Systematic Reviews, MedicLatina, Nursing & Allied Health Collection, Web of Science and Scopus®. We included a search for grey literature and unpublished material in the scientific repositories such as Repositório Científico de Acesso Aberto de Portugal (RCAAP), OpenGrey, ProQuest, Mednar and Google Scholar. Any type of quantitative, qualitative, mixed methods studies or systematic reviews was included. Two independent reviewers evaluated each selected study.
Results: This review included 19 studies. The importance of an interdisciplinary approach is highlighted. A pre-decannulation assessment of conditions such as: level of consciousness, dependence on mechanical ventilation, ability to cough, need for tracheal aspiration, swallowing ability, permeability of the upper airways, and hemodynamic and clinical stability is suggested. Reference is made to the importance of using high-flow oxygen therapy and non-invasive ventilation in decannulation. Suggested interventions are reducing the caliber of the tracheostomy tubes, deflating the cuff and implementing individualized rehabilitation programs. These should include generalized muscle training, with a special focus on respiratory muscles, use of electronic devices for respiratory training, motorized devices for bed training and electrostimulators. The importance of respiratory kinesiotherapy is also suggested, with a focus on cough training and airway clearance.

Conclusions: For a successful decannulation it is important to do a previous evaluation of selected parameters. The decannulation decision must be made by an interdisciplinary team, with the presence of rehabilitation nursing. An individual rehabilitation program that includes muscle reinforcement, cough training and respiratory therapy should be implemented. Non-invasive ventilation or high flow oxygen therapy can be administered, as an adjunct to increase the opportunity for success.
Implications for research and practice: It is important to develop studies about the implementation of rehabilitation nursing interventions, with an evaluation of their benefits in successful decannulation, eventually quasi-experimental or experimental studies. These findings will guide the authors on the development of a decannulation protocol, to critically ill patients, that must involve a complete patient examination, as well as an IRP tailored to the needs identified during the evaluation, so that a successful and safe decannulation may be performed.
Keywords: Decannulation; Nursing; Rehabilitation; Tracheostomy; Ventilatory weaning

Introduction

Intensive care units (ICU's) can be categorized into three levels of care. Level III units are responsible for advanced monitoring or multi-organ support on patients that require, at least, one specialized critical care nurse for every patient. They ensure respiratory care (extracorporeal membrane oxygenation-ECMO or carbon dioxide removal, invasive and non-invasive ventilation), cardiovascular care (intra-aortic balloon pumps, improved cardiac output monitoring, vasopressors, inotropes, ventricular assist devices, and ECMO), renal support (kidney replacement treatments) and neurological care (advanced neurological monitoring, electroencephalogram and intracranial pressure monitoring) (Jackson & Cairns, 2021).

When a critical care patient experiences a ventilatory failure or an inability to promote ventilation, one of the therapies used is mechanical ventilation (MV). Invasive MV assumes the use of devices, such as an endotracheal tube, a tracheostomy (TT) or a laryngeal mask airway, to provide the therapy. Maintenance of the endotracheal tube may cause complications to the patient. The process of weaning the patient from invasive artificial ventilation (ventilation weaning) is not a simple procedure and can occasionally be challenging (Burns et al., 2021). Ventilatory weaning can be categorized according to duration and attempts. This study considers the International Consensus Conference (ICC) classification (Lago et al., 2019). Several factors related to the patient's condition and cause of acute respiratory failure can led to a longer weaning process (Schreiber et al., 2019).

Performing a TT reduces the work of breathing and accelerates ventilatory weaning (Guia et al., 2021). In critically ill patients, this procedure, is related to sedation weaning, decrease length of stay and possible complications, communication improvement, a better airway clearance and active participation in the rehabilitation process (through the increase of

autonomous work, which enables a minor loss of muscle mass), allowing the transfer of patients to less differentiated units, with lower costs (Barry & Bodenham, 2004; Bösel, 2014; O'Connor & White, 2010; Shinn et al., 2019). However, the extended presence of a TT tube may have a negative impact on patient's conditions, such as, dysphagia worsening, granulomas development and hemorrhage (Fernandez-Bussy et al., 2015). Many times, the TT tube is perceived as a foreign body and can cause bronchorrhea or excessive coughing (Aljedaani et al., 2020).

A prolonged stay in ICU often results in large muscle loss and development of ICU acquired muscle weakness, more notorious if the patients have a TT (Rose et al., 2017). Several authors argue that intensive, interdisciplinary, and early rehabilitation should be offered to these patients, with the aim of minimizing periods of immobility, promoting functional independence and autonomy in Activities of Daily Living (ADL's). (Fuke et al., 2018; MacIntyre, 2019; Schreiber et al., 2019).

Therefore, TT should be removed as soon as possible. Daily evaluations of the requirement to uphold a TT are recommended. It is important to execute decannulation (DEC) as soon as feasible (Mehta & Mehta, 2017). DEC is fundamental in critically ill patients' rehabilitation, not only because of the risk of complications caused by the presence of TT, but also due to the negative repercussions on patient's social life (Ceriana et al., 2003). Inability to communicate verbally, often leads to depressive mood and has a negative impact in patient's quality of life (Bach et al., 2014).

Approximately 40.8% of the population are decannulated 3 months after performing the TT (Ishizaki et al., 2022). DEC of 63.9% and 65% required 12 and 24 months, respectively. Up to three months, DEC rates quickly increase, but after 12 months they reached a plateau (Ishizaki et al., 2022). These findings, found by Ishizaki (2022), emphasize the significance of early intervention in tracheostomized patients, ventilatory weaning, and eventual DEC.

There is no agreement on a universal procedure for weaning from TT and consequent DEC (Aljedaani et al., 2020; Mehta & Mehta, 2017). Therefore, several authors call the use of weaning/DEC protocols. Despite the relevance and significance of this procedure, there is no approved method for its execution (Singh et al., 2017b). There is little information on the role of the rehabilitation nurse. It is known that identifying predictors of successful DEC minimizes the risk of respiratory infections, associated with prolonged intubations, and prevents DEC failures (Chan et al., 2010). Understanding the effectiveness of interventions is associated with the involvement of an interdisciplinary team, during preparation and decision-making for DEC (Gundogdu et al., 2017; Mah et al., 2017; Thomas et al., 2017b; Welton et al., 2016).

For these reasons, the objective of this scoping review is to map and analyze the rehabilitation intervention in the process of DEC of critically ill patients. This will allow the creation of a DEC protocol in this subject.

In a preliminary search on PROSPERO (International Prospective Register of Systematic Reviews), Joanna Briggs Institute® (JBI®) and Open Science Framework® (OSF®), no current or in-progress scoping reviews or systematic reviews on the topic were identified.

This review was conducted in accordance with a published a priori protocol (Correia et al., 2023).

Review question

This review was guided by the question:

"In tracheostomized patients, admitted in ICU, what is(are) the rehabilitation intervention(s) that promote successful decannulation?"

The research question was developed using the vocabulary found in the preambular research and can be consulted in Table 1 from the supplementary material (Appendix IV).

Eligibility criteria

Participants:

This scoping review considered studies that included critically ill patients, aged over 18 years, whose TT was performed in the context of difficult or prolonged ventilatory weaning and who experienced rehabilitation. Considering that this review aims the development of a protocol for DEC of critically ill patients, adults, studies developed in a pediatric population (less than 18 years old) were excluded. We also excluded studies whose patients underwent a TT procedure due to surgery (scheduled or not) in the context of maxillofacial or otorhinolaryngological pathology and studies that weren´t written in Portuguese, English, French and Spanish.

Concept

The main concept of interest is DEC, that is described as the process of removing the tracheostomy tube (Everitt, 2016).

Context

This review included patients admitted in a level III ICU. For the purpose of providing adequate care at the respiratory (invasive or non-invasive ventilation and extracorporeal membrane oxygenation-ECMO), cardiovascular, renal, or neurological level, level three ICUs

are defined as having resources for admitting patients who require multiorgan support, advanced monitoring techniques and, at least, one intensive care nurse dedicated to each client (Jackson & Cairns, 2021).

Types of Sources

This review considered experimental and quasi-experimental studies, including randomized controlled trials, non-randomized controlled trials, before-after studies, and interrupted time series studies, analytical observational studies, including prospective and retrospective cohort studies, case-control, analytical cross-sectional, descriptive observational, including case series, individual case reports and cross-sectional descriptive studies. Qualitative studies were also included, including but not limited to designs such as qualitative description and action research. No systematic or scoping reviews were found, therefore none were included.

Methods

This review was conducted in accordance with the JBI® methodology for scoping reviews (Peters et al., 2021).

Search strategy

A preliminary search was performed, limited to Medline via PubMed and Cumulative Index to Nursing and Allied Health Literature® (CINAHL®) via EBSCOhost, to identify the evidence on the topic of DEC. An analysis of the vocabulary present in titles, abstracts, and keywords, used to describe the subject under study, was performed.

The search strategy of this review aimed to map published and unpublished evidence. Therefore, controlled vocabulary such as MeSH (Medical Subject Headings)/ DECS (Descriptors in Health Sciences) and keywords in natural language were included.

After defining the main concepts, the search, using keywords (associated with boolean operators) and controlled vocabulary, was performed in selected data sources: MEDLINE via PubMed, CINAHL® via EBSCOhost, Cochrane Database of Systematic Reviews, MedicLatina and Nursing & Allied Health Collection, Web of Science and Scopus®. We conducted a search for grey literature and unpublished material in scientific repositories, such as RCAAP, OpenGrey, ProQuest, Mednar and Google Scholar. This information can be consulted on the supplementary material (Apendix V – Table 2).

A summary of the research strategy can be found in Appendix I.

Study/Source of Evidence selection

The boolean expression was applied on November 25, 2022, and the results obtained were managed through EndNote®, in its online version with WoS (Clarivate Analytics, US). The databases consulted can be checked in table 3, from the supplementary material (Appendix IV). The search strategy, from each database can be found in the same supplementary material (tables 4 to 8).

It should be noted that, for research in the grey literature, the boolean expression was adjusted due to limitations related to the search system itself. For this reason, table number 4 describes the boolean expressions used, after the adjustments to the respective limitations.

Duplicated results were selected and excluded, using EndNote®. No time interval was defined, and all results were included.

All articles that were not written in the selected languages and described in the protocol (Portuguese, English, French and Spanish) were eliminated.

Then all the results, including titles and abstracts, were analyzed by two reviewers, independently, accordingly to the inclusion criteria for the review.

Two reviewers examined the results in full text, according to the inclusion criteria. There were no disagreements between the reviewers, and no need to consult a third reviewer. Studies identified from the reference lists were included (figure 1). The detailed justification for excluding studies considered for full-text can be found in Appendix II.

Data Extraction

Data was extracted by using an instrument developed for this purpose, which includes relevant information to the review question, such as details about the participants, concept, context, methodology and key findings.

The data extracted from the selected sources were compiled using the extraction tool, developed by the authors and built in accordance with the JBI® recommendations (Francis, 2022) and can be consulted in Appendix III.

Results

A total of 3237 articles were found. After removing the duplicates, book chapters and articles on not included languages, the authors analyzed 1507 articles. A total of 1347 articles were excluded in the analysis of their title and summary, for not meeting the inclusion criteria. Thus, 160 articles for full reading were obtained. Of the articles considered for Full-Text 19 were included in Scoping Review.

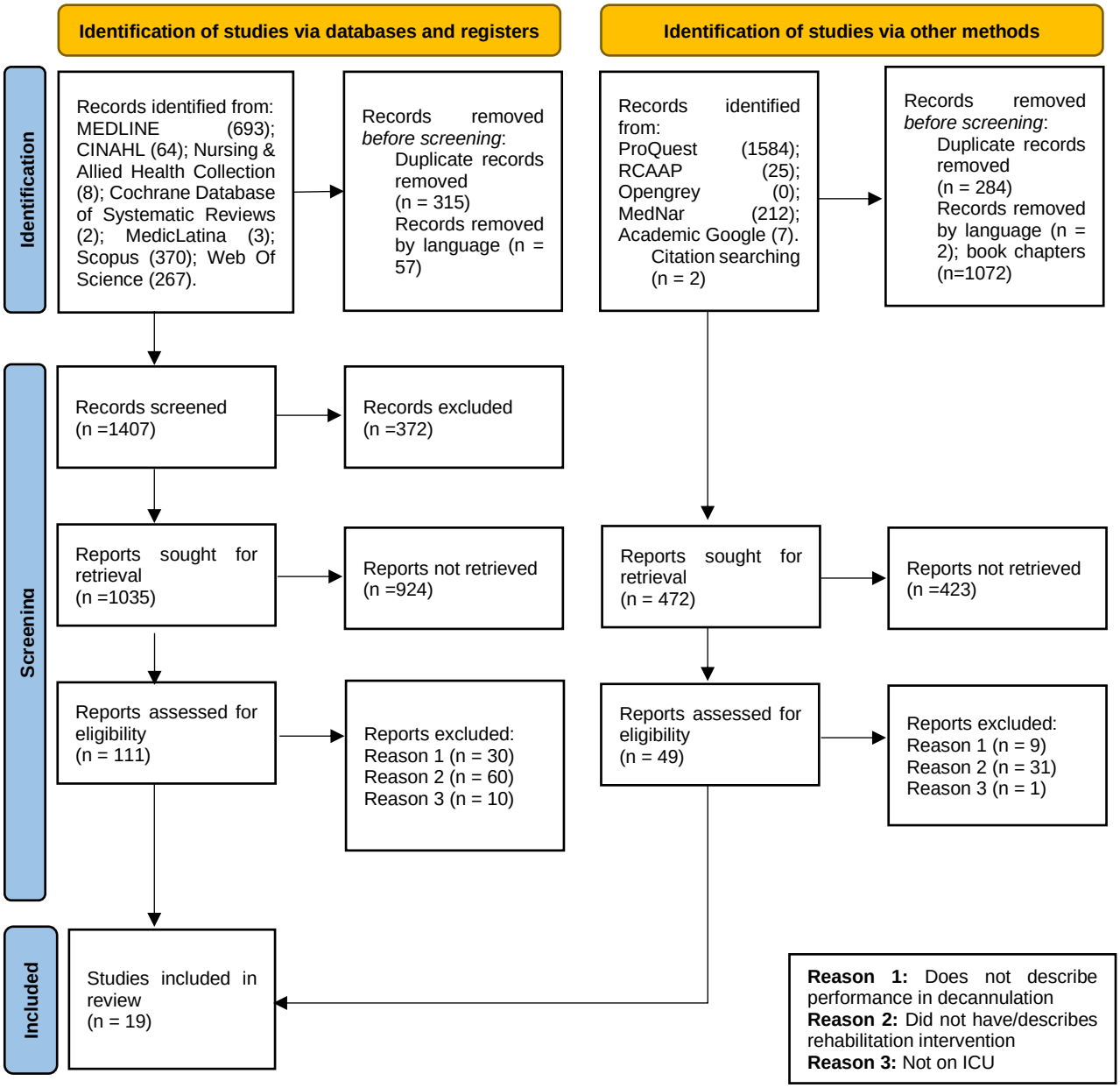

Figure 1: PRISMA flowchart of the study selection and inclusion process

Adapted from Page, et al. (2021)

The studies included aimed the analysis of 2288 participants, with the larger sample of 367 patients and the smallest of 7 (Table 1). The sample of the studies has an average age of 58.7 years, mostly represented by males, with acute physiology and chronic health evaluation (APACHE) II scores ranging from 11 to 19, simplified acute physiology score (SAPS) II between 21.5 and 26, SAPS III of 53.9 and Barthel index between 5 and 28.4.

The selected studies describing the professionals involved have the collaboration of nurses, physiotherapists, respiratory therapists, physicians and speech therapists (Table 1). Of the 19 primary studies selected by the authors, 7 mention the participation of nurses (Costi et al., 2022b; Hernandez et al., 2013; Luo et al., 2014; Park et al., 2021; Sood et al., 2021; Zhou et al., 2022), and 3 of them describe the participation of nurses specializing in respiratory rehabilitation care (Costi et al., 2022b; Luo et al., 2014; Park et al., 2021) and 1 specialized nurse in cardiopulmonary rehabilitation (Zhou et al., 2022). They have success rates in DEC ranging from 40.1% to 100%, with average delays that oscillate between 6 days and 7 months.

Previously to DEC some parameters are evaluated (Table 2). Those that are most repeated are: the level of consciousness/collaboration of the patient, weaning from MV, effectiveness of coughing, the need for tracheal aspiration, stability of peripheral oxygen saturation, swallowing capacity, permeability of upper airway and clinical and hemodynamic stability.

The procedures used by the authors for DEC are described in Table 3: high flow oxygen therapy, TT cannula replacement, spontaneous breathing test, CUFF deflation, TT occlusion test, TT cannula caliber reduction, cannula replacement by Minitrach and implementation of Individual Rehabilitation Program (IRP). One of the studies describes that accounting for the number of invasive medical devices in admission (tubes and catheters) and the number of days in ventilatory weaning are indicators considered as risk factors for the success of DEC (Thomas et al., 2017b): the smaller the number of devices and number of days in weaning, the earlier and successful may be a DEC. Implemented IRP are described in Table 4. These programs include passive, assisted and active mobilization exercises, peripheral, respiratory and widespread muscle reinforcement exercises, early stand up, orthostatic position training, neuromuscular electrostimulation, speech therapy exercises, training swallowing and sensory stimulation. They also include respiratory kinesitherapy exercises such as respiratory control exercises, cough training, assisted cough (mechanically or not) and airway cleaning techniques. Chan et al. (2010) define in their study that an important successful predictor in DEC of the neurosurgical patient is the value of peak cough flow (PCF).

Patients included in these studies have several different reasons for admission to UCI's, including trauma, oncology, muscle dystrophies, spinal cord injuries, chronic and acute respiratory diseases, post-surgical, including neurosurgical.

Table 1: Included studies by authors, publication year, country, sample, professionals involved and decannulation success

Authors (Publication year)	Country	Population (Sample)	Professionals involved	Decanul. success
Aljedaani, Y., et al. (2020)	Saudi Arabia	102	Physicians, otolaryngologists, respiratory therapists, **nurses**	97,7%
Bach & Saporito (1996)	USA	49	----	----
Bach et al. (2014)	USA	7	----	86%
Ceriana, P., et al. (2003)	Italy	108	----	78%
Chan, L.Y.Y., et al. (2010)	China	32	Physiotherapists, physicians	66%
Costi, S., et al. (2022b)	Italy	180	Physicians, **specialized nurses**, physiotherapists, nutritionists, psychologists	45,6%
Enrichi, C. et al. (2017)	Italy	74	Neurologist, speech and language therapist, respiratory therapist, otorhinolaryngologist	73%
Hernandez, G., et al. (2013)	Spain	195	Physicians, respiratory therapist, **nurses**	52%/47%
Kim, D. H., et al. (2017)	South Korea	62	----	100%*
Lemyze, M., et al. (2022)	France	50	Respiratory therapists, attending intensivist	100%*
Luo, C., et al. (2014)	China	21	**Nurses specialized in respiratory care**	100%*
Martínez, G. H., et al. (2020)	Spain	330	----	94,4%/97,6%
Park, C., et al. (2021)	South Korea	346	Attending physicians, **nurses specialized in respiratory care**	43,1%
Pasqua, F., et al (2015)	Italy	48	----	58,3%
Sood,, R. N. , et al. (2021)	USA	37	Respiratory therapist, **nurses**, pulmonology, thoracic surgery, and critical care physicians	48%
Thomas, S., et al. (2017b)	Germany	122	Neurologists, otorhinolaryngologists, consultants of internal medicine, speech therapists, physiotherapists, occupational therapists	100%*
Wang, X., et al. (2022)	China	367	----	40,1%
Zhou, T., et al. (2022)	China	92	Respiratory and critical care physicians, neurologists, otolaryngologists, physiotherapists, speech therapists, **critical care and cardiopulmonary rehabilitation nurses**	98,2%
Zivi, I., et al. (2018)	Italy	66	----	70%

*Studies that only considered patients that were decannulated

Table 2: Conditions evaluated before decannulation

		Aljedaani, Y., et al. (2020)	**Ceriana, P., et al.** (2003)	**Chan, L.Y.Y., et al.** (2010)	**Costi, S., et al.** (2022b)	**Hernandez, G., et al.** (2013)	**Kim, D. H., et al.** (2017)	**Lemyze, M., et al.** (2022)	**Martínez, G. H., et al.** (2020)	**Park, C., et al.** (2021)	**Pasqua, F., et al.** (2015)	**Sood., R. N. , et al.** (2021)	**Wang, X., et al.** (2022)	**Zhou, T., et al.** (2022)	**Zivi, L., et al.** (2018)	**Bach & Saporito** (1996)	**Enrichi, C., et al.** (2017)		**Total**
Absence of delirium			*X*					*X*					*X*						**3**
GCS >8 / Conscious, oriented and cooperative		*X*		*X*	*X*		*X*			*X*					*X*	*X*	*X*		**9**
Recovery from reason of TT		*X*																	**1**
Absence of infection			*X*													*X*			**2**
Absence of procedures requiring anaesthesia		*X*																	**1**
Weaning from MV		*X*			*X*			*X*				*X*	*X*						**5**
Assessment of vital capacity																*X*			**1**
Coughing ability	PCF >160L/min	*X*		*X*						*X*				*X (100L /min)*	*X*	*X*	*X*	(7)	**10**
	MEP* >40cmH 2 O		*X*								*X*		*X*					(3)	
Need for tracheal suctioning	No more than once per day	*X*			*X*										*X*			(3)	**6**
	More than 4/4h			*X*						*X*							*X*	(3)	
Stable O_2 saturation					*X*						*X*					*X*		(4)	**7**
	No O_2 supply	*X*					*X*										*X*	(3)	
$PaCO_2$ < 60mmHg			*X*								*X*		*X*			*X*			**4**
Gag reflex		*X*	*X*										*X*						**4**
Swallowing test	Blue dye teste	*X*	*X*			*X*		*X*	*X*			*X*	*X*			*X*		(8)	**14**
	Videofluoroscopy	*X*	*X*			*X*					*X*		*X*			*X*		(6)	
Assessment of Upper airway clearance	Bronchoscopy	*X*	*X*				*X*				*X*				*X*	*X*		(6)	**12**
	Speech valve												*X*	*X*				(2)	
	Occlusion test					*X*			*X*	*X*		*X*						(4)	
Hemodynamic/clinical stability			*X*			*X*					*X*		*X*	*X*		*X*			**7**
Risk of aspiration					*X*				*X*										**2**

*MEP - Maximal expiratory pressure

Table 3: Decannulation procedures

	Aljedaani, Y., et al. (2020)	**Bach et al.** (2014)	**Ceriana, P., et al.** (2003)	**Costi, S., et al.** (2022b)	**Hernandez, G., et al.** (2013)	**Kim, D. H., et al.** (2017)	**Lemyze, M., et al.** (2022)	**Luo, C., et al.** (2014)	**Martinez, G. H., et al.** (2020)	**Park, C., et al.** (2021)	**Pasqua, F., et al.** (2015)	**Sood, R.N., et al.** (2021)	**Wang, X., et al.** (2022)	**Zhou, T., et al.** (2022)	**Zivi, L., et al.** (2018)	**Bach & Saporito** (1996)	**Enrichi, C., et al.** (2017)
IRP				*X*		*X*	*X*	*X*		*X*	*X*		*X*	*X*	*X*	*X*	
High Flow oxyg.					By TT 2 groups: **inflated cuff** vs **deflated cuff**.				**Control G.**: intermit. **Interven G.**: continuous								
Replacement of TT		Fen. with cuff			Fen., in deflated cuff group	Fen., cuffless					Fen.					Fen. with cuff	
Spontaneous breathing test					2 times /day, progressive up to 12 h, on 2 consecutive days				2 times / day, progressive up to 12 h, on 2 consecutive days		Up to 48h			With speak. valve, up to 4h			
Cuff deflation	*X*	MV configured with pressure to compensate leaks								*X*							
TT occlusion test	**1st day**: 30min, every 3h **2nd day**: 12 hours **3rd day**: 24 hours		3 to 4 days	Progressive from 12h to 24h.		With nasal or oronasal NIV		Humidific. and warm up. air		*X*	*X*	12 hours for 3 consecutive days	3 to 4 days		24h	With NIV	72h
Caliber reduction of the TT			Reduction to 6mm	To size 4.				Gradually		*X*		When they do not tolerate occlusion	For 6mm				
Cannula replacement for miniTrach			1 week, when cough not effective														

Table 4: IRP – Indivudual Reabilitation Program

Author	**Bach & Saporito** (1996)	**Costi, S., et al.** (2022b)	**Kim, D. H., et al.** (2017)	**Lemyze, M., et al.** (2022)	**Luo, C., et al.** (2014)
IRP	For patients who fail the 1st DEC attempt: • air stacking manoeuvres.	Initial assessment + PRI up to 48 hours after admission Training 1h, 2 times/day. (Intensity ajusted to gravity): • Respiratory muscle strengthening; • Peripheral muscle strengthening; • Secretion management; • Breathing exercises; • Assisted cough; • Positive pressure ventilation with occluded TT (hypercapnic patients).	• Assisted cough (mechanical or manual). • Air Stacking exercises (lung expansion).	Training 2 times/day, in a gym attached to the ICU. • Early weaning sedation; • Passive mobilization in bed (with motorized device); • Active mobilization; • Early stand up; • Standing position training.	1. Criteria for TT caping: • Ensure humidification and warming of the air; • Secretions suctioning; • Effective communication. 2.Training with caped TT: • Training with semi-occluded or momentarily caped cannula; • When occlusion was tolerated, the cuff was deflated and the cannula caped with a rubber device with two holes, through which humidified and warmed oxygen was administered. 3.Gradually reduce the TT size. 4.Deep breathing exercises • Abdominal breathing training, with pursed lips (to increase tidal volume and functional residual capacity) 10 min / 3 to 4 times/day; • Training with a breathing device (to develop prolonged and sustained inspirations) 10 to 15 min / 2 times a day. 5. Thoracic Physiotherapy (percussion and vibration, together with postural drainage, to eliminate secretions) • Percussion: 5min every 4 or 6 hours; • Vibration: 15 to 30 min / 2 times a day. 6. Manually Assisted Cough (quad technique cough). 7.Analysis of criteria for DEC.
Author	**Park, C., et al.** (2021)	**Pasqua, F., et al.** (2015)	**Wang, X., et al.** (2022)	**Zhou, T., et al.** (2022)	**Zivi, I., et al.** (2018)
IRP	Muscular rehabilitation, with reinforcement in patients who did not tolerate the occlusion test;	• Active mobilization of members; • Electrostimulation of the quadriceps; • Strengthening of the abdominal muscles; • Training of respiratory muscles; • Strength training (cycle ergometer for lower limbs and arm ergometer for upper limbs); • Airway clearance techniques.	• Progressive peripheral muscle training; • Breathing exercises; • Electrical stimulation ; • Speech therapy; • Swallowing training.	Physical and pulmonary rehabilitation: • Airway clearance training; • Respiratory muscle training; • Physical training.	60 min/day: • Mobilization in bed; • Sensory stimulations; • Verticalization training (ErigoR scale - Hocoma , Switzerland).

Discussion

In this review 19 primary studies were included. No review responded to the research criteria.

There is an increase of studies and publications in this area of interest in the last ten years. Due to scarcity of studies in rehabilitation nursing, we conducted a more embracing survey, being researched studies in all of health professional areas that implement their intervention in the Rehabilitation, in general. There are a small number of countries that currently have a nursing specialty in rehabilitation (Schoeller et al., 2018), which may explain the lack of studies published in this context.

There is no agreement on the most appropriate time to decannulate or the best intervention to perform, for the safety of the procedure (Aljedaani et al., 2020; Budweiser et al., 2012; Ceriana et al., 2003; Heidler et al., 2018; O'Connor & White, 2010; Pandian et al., 2012; Santus et al., 2014). DEC is a challenging decision, but when it is made based on objective criteria it can be safer (Aljedaani et al., 2020).

It is suggested that the DEC decision should be made by an interdisciplinary team (which includes nurses), bringing numerous advantages, namely (Bedwell et al., 2019; Brenner et al., 2020; Farrell et al., 2019; McGrath et al., 2020):

- Comprehensive evaluation: an interdisciplinary team, consisting of physitians, nurses, respiratory therapists, speech therapists, among others, can provide a unique perspective and contribute to different specific skills to a broader and accurate assessment in the patient's evaluation to determine if they are ready for DEC.
- Shared decision making: The decision to decannulate is very complex and involves risks, but when shared, with discussion of the case, exchange of opinions and knowledge, it can become safer, minimizing possible errors or omissions.
- Reduction of errors and complications: With a team involved there is a greater probability of identifying risk factors and potential complications. Each professional can contribute with their expertise and experience, to mitigate these risks and adopt appropriate preventive measures.
- Better planning post-DEC: Careful planning of this period can be performed. Each team member can contribute to specific guidelines related to their area of

expertise. This ensures that the patient receives proper care and the necessary support after the procedure, increasing the probability of success.

- Holistic approach: The team adopts a holistic approach, considering, not only the patient's medical condition, but also, psychosocial, emotional and quality of life. This is especially important in the decision to decannulate as it involves the transition to natural breathing, without support. Different professionals can evaluate and address the needs of the patient in various areas, promoting a more effective global recovery.

Part of the success of DEC comes from a correct assessment of the patient before the proceeding, namely neurological assessment, presence/quantity of bronchial secretions, swallowing capacity and clinical and hemodynamic stability. The success of DEC requires almost perfect coordination from brain, swallowing, coughing, phonation and breathing muscles (Bishnoi et al., 2022).

One of the findings of this review is the possibility of decannulating patients, with high spinal cord injuries, with the rehabilitation intervention. One of the first procedures should be the cuff deflation of the TT cannulas (Bach et al., 2014). Early DEC allows lower treatment costs and reduction of depressive pathology. Luo et al. (2014), in their rehabilitation nursing intervention plan, also practice the occlusion of the cannula and cuff deflation. One of the results found with this study was the increase of the effective diameter of the airways. It is recommended to decrease the caliber of the TT cannula gradually in order to increase this diameter (Luo et al., 2014). Hernandez et al. (2013), noted that patients who were decannulated with a protocol that included the cuff deflation had a higher success rate, a shorter time until DEC, a lower rate of respiratory infection, a better swallowing function and lower mortality rate. The diameter of the airways is considered elementary for DEC (Aljedaani et al., 2020; Bach & Saporito, 1996; Ceriana et al., 2003; Kim et al., 2017; Pasqua et al., 2015; Santus et al., 2014; Zivi et al., 2018), from the importance of the lack of granulomas or obstructions, to the importance of cuff deflation and reduction of TT cannula caliber (when patients perform training with capped TT). Two studies, which investigate respiratory resistance applied by the presence of a TT cannula seem to explain this phenomenon (Carter et al., 2013; L. N. Pryor et al., 2016). In healthy individuals, total respiratory work ranges from 0.3 to 0.6 joules. In ventilatory weaning, it can be difficult to determine the ideal respiratory work; If it is too low, atrophy of the respiratory muscle may occur; If it is too high, exhaustion and aggravation of respiratory failure may happen. Small sizes TT generates a sharp restriction on respiratory flow and increased respiratory work

(Carter et al., 2013; J. Pryor et al., 2009). The consulted articles, suggest larger cannulas for ventilation through the TT and reducing their size when the patient tolerates the TT caping and starts ventilation by the upper airways (Carter et al., 2013; J. Pryor et al., 2009).

The evaluation of airway permeability emerges as a predominant factor in the success of the DEC in several of studies of this review (Aljedaani et al., 2020; Bach & Saporito, 1996; Ceriana et al., 2003; Kim et al., 2017; Pasqua et al., 2015; Santus et al., 2014; Zivi et al., 2018). According to Warnecke (2013), Matesz (2014) and their respective collaborators, the permeability of the upper airways has been cited as an important indicator of successful DEC. It can be evaluated through digital occlusion, with the insertion of a gloved finger at the outer end of the TT cannula during exhalation, or through transtracheal pressure manometry measurement, through a speaking valve (Li et al., 2021; Martin et al., 2021). Cuff's deflation and the use of speaking valves can be started during MV administration. Early rehabilitation of the upper airway can lessen the possible complications resulting from cuff pressure (Lian et al., 2022). A study that evaluates the advantages perceived by patients, using speaking valves, describes that they allow to improve communication, swallowing, taste and smell, coughing capacity, but also reduce the number of tracheal aspirations and levels of anxiety (Soneghet et al., 2007).

The ability to cough efficiently is one of the most repeated criteria, evaluated for DEC, when analyzed the protocols of primary studies. PCF assessment is a predictor of success in DEC and represents a simple and easily implementable intervention, which will allow professionals to prevent complications such as respiratory infections: minimum PCF value for successful DEC, 29L/min (Chan et al., 2010), which represents a significantly lower value than recommended by other authors. Bach e Saporito (1996) recommend a 160L/min PCF while, Winck and his collaborators (2015) recommend values exceeding 60L/min. However, the evaluations carried out in these studies were developed with significant differences in the procedure, which may explain these variations, such as leaks when measurements were made with a deflated cuff, differences in cough inducer stimulus, presence/absence of external cough aid and intervention that increased inspiratory volume, previously to measurement of PCF. This parameter has been the subject of several studies over the years, with significant differences in the found values. In a literature review, published by Jiang et al. (2017), the authors conclude that valuing PCF's evaluation seems to represent a protective factor of failure in DEC/extubation. They also report that the evaluation of this parameter is associated with reduced hospitalization time and morbidity. However, they conclude that more rigorous

studies (methodologically), should be performed, so that a optimal PCF value is recommended and universally accepted.

The use of noninvasive ventilation (NIV) and mechanically assisted cough, in patients with very difficult weaning, such as those with cervical spinal cord injury experience (Kim et al., 2017), can influence the success of DEC. In Kim et al. (2017) study, all patients were decannulated and a good part of them were weaned from NIV later. Patients with little capacity to ventilate or cough could, thus, be decannulated with the aid of the rehabilitation team. Recently, a literature review has been published, whose conclusions meet these findings: NIV plays a major role for weaning patients with TT (Guia et al., 2021).

There are advantages of using high flow oxygen therapy, together with the evaluation of the need for tracheal secretion aspiration, namely, reduction of time to DEC, higher success rate, reducing hospitalization time and respiratory infection rates (Martínez et al., 2020). Heated humidification of oxygen in TT patients improves ciliary mucus conduct, reduces the need for tracheal aspirations, improves oxygenation, reduces respiratory rate and induces some positive expiratory pressure (Birk et al., 2017; Natalini et al., 2019).

The implementation of a global rehabilitation program for TT patients is also recommended (Costi et al., 2022b). Advanced age and higher scores of CIRS and SAPS II are associated with worst functional recovery. For this reason, this data should be collected on patients admission and IRPs should be initiated as early as possible and fitted to the individuality of each patient (Costi et al., 2022b). Martin et al. (2021) show in their study, that weakened patients in UCI should be subject to global and respiratory muscle reinforcement, to be successful in ventilatory weaning.

Lemyze et al. (2022) developed an alternative strategy for conventional DEC, with a program that is called “5 D's strategy” (**D**ecrease delirium, disuse syndrome and nutritional deficiencies; **D**eventilate; **D**eflate the cuff; **D**etect swallowing disorders; **D**ecannulation). This program consists of applying five groups of interventions, that aim to facilitate a successful DEC. Associated with this strategy, the rehabilitation team developed a personalized rehabilitation program for muscle, diaphragmatic and neurocognitive recovery. To this end, motorized mobilization devices, active muscle exercises, early stand up and orthostatic position training were developed, with bi-diary training, on a gym attached to the UCI. This resulted in 96% of successful DEC. The combination of the 5 D’s strategy, with intensive rehabilitation allowed, not only the DEC of the vast majority of patients, but also, stimulated their mental recovery (reduction anxiety, depression and vulnerability), improved the autonomy for the ADLs and 6-minute march test scores. The implementation of early

rehabilitation, in addition to being safe, can develop positive effects on physical, cognitive and psychosocial patients recovery. (Faure et al., 2022; Kinoshita et al., 2022; Stutz et al., 2021; Thomas et al., 2017b; Wang et al., 2022; Zivi et al., 2018). It is also concluded that a higher MRC score of the upper limbs and a better functional status, may be predictors of greater safety and success in DEC (Thomas et al., 2017b). According to Faure and his collaborators (2022) the MRC measurement should be performed on ICU patients evaluation, as it is, noticeably, an aspect associated with early DEC. The authors in question, also recommend global muscle strengthening, with special attention to the diaphragm.

Also, noteworthy, is the importance of respiratory rehabilitation, performed by nurses, in patients with TT and acute spinal cord injury (Luo et al., 2014). Some of the interventions, developed by nurses, who implement respiratory rehabilitation, involved training with capped cannula, cuff deflation, decreasing the TT cannula caliber and muscle training (Luo et al., 2014). A set of respiratory kinesiotherapy interventions (vibration, percussion, training with a breathing device and respiratory muscle strengthening) should be implemented to increase tidal volume and functional residual capacity (Luo et al., 2014). Pasqua et al. (2015) implemented, in their study, a DEC protocol in patients who underwent pulmonary rehabilitation with a success rate of 63%. Their rehabilitation plan included, similarly to the findings of this study, active mobilization of the limbs, electrostimulation of the quadriceps, reinforcement of the abdominal muscles, training of respiratory muscles, strength training (cycle ergometer for lower limbs and arm ergometer for upper limbs) and airway clearance techniques. The use of electronic respiratory muscle training devices is safe, promotes increased ventilatory capacity and leads to a shorter ventilator weaning time (Tonella et al., 2017). Prolonged use of MV leads to respiratory muscle weakness, which seems to be preventable or reversible with training and muscle reinforcement. Respiratory rehabilitation can play a key role in preparing the patient to breathe without TT. This can provide muscle strengthening and lung re-expansion, thus improving the patient's ventilatory capacity and facilitating DEC. It can also provide breathing exercises and bronchial hygiene techniques to help remove tracheal secretions and prevent respiratory complications, such as infection (Papi et al., 2022).

In 2021, a predictive scoring system for success in DEC, called DECAN, was developed (Park et al., 2021). This instrument allows a standardized and systematized approach in the assessment of the patient's conditions, providing objective criteria to determine whether he is prepared for a successful DEC, thus helping health professionals to make informed and safe decisions in this process. However, it is still necessary to carry out

studies with larger samples, in order to correctly evaluate the performance of the instrument in question. Wang et al. (2022) developed a predictive model of DEC success, for neurological patients, using a nomogram, created with the collection and analysis of the conditions that interfered in the success of DEC, in a time interval of 6 months, after the performing the TT. Variables with statistical implication were age, National Institute of Health stroke scale (NIHSS) score, early rehabilitation, shock and secondary surgery. According to Mortensen et al. (2020), the teams that decide to decannulate can benefit from the use of tools that estimate the probability of its success, when assessing patients rehabilitation potential.

Scoping Review Limitations:

One of the found limitations was the use of a linguistic filter. The reduced number of articles excluded by language and the current offer of translation tools, lead the authors to consider, in a future study, to not proceed to any exclusion, for the reason in question.

Some studies with ventilated and tracheostomized patients, in a physical environment outside of the ICU, were excluded, meeting the inclusion and exclusion criteria, namely those that took place in specialized weaning and DEC units. In these units, intensive rehabilitation is carried out, to enhance the success of DEC. Therefore, we cannot guarantee that potentially relevant information was not excluded.

Conclusion

DEC with an interdisciplinary approach, including nurses, is safer and has a better prognosis for success. The need for a prior evaluation of the conditions that interfere with a successful DEC was identified. It is also recommended to deflate the cuff at an early stage, and to value the diameter and permeability of the airways. It is also advised to use the administration of NIV or high flow oxygen therapy, in challenging cases. The biggest recommendation concerns the implementation of IRP with a focus on muscle strengthening, cough training and respiratory kinesiotherapy. The percentage of success in DEC varies a lot when we compare the primary studies, however, the characteristics of the patient samples are not homogeneous and, for this reason, difficult to compare.

Implications for research and practice:

The results found in this study are useful for practical guidance on the performance of the rehabilitation nurses, on DEC of critically ill patients. However, it is considered necessary that more primary studies be carried out, by the professionals in question, on this area of

interest, since the rehabilitation nurses play a preponderant role, on DEC of critical patients, in Portuguese ICUs. This study will assist in the development of one protocol to the DEC of critically ill patients, for the rehabilitation nurses. The protocol must include a detailed evaluation of the patient, prior to DEC, an IRP adjusted to the needs diagnosed after the assessment, so that a successful and safe DEC can subsequently be carried out.

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Conflicts of interest

There is no conflict of interest in this project.

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Appendix I
Scoping Review Search Strategy

Scoping Review Search Strategy

1	Introductory survey without identifying scoping review on the topic: Decannulation of critical ill patients after difficult/prolonged ventilatory weaning.
2	Identification of the most used and appropriate words/indexing terms for the selected databases – MeSH/ DeCS terms and NCBI: MeSH database.
3	Construction of the boolean expression.
4	Search in two recommended databases: MEDLINE (via PubMed) and CINAHL® (via EBSCOhost).
5	Analysis of present words/indexing terms present in titles and abstracts of the obtained evidence.
6	Search in other databases, applying the respective boolean expression.
7	Grey literature search.
8	Exportation of the evidence to EndNote® online with WoS version (Clarivate Analytics, US) reference management software.
9	Checking and removing duplicate literature.
10	Application of inclusion criteria: Portuguese, English, Spanish and French literature.
11	Analysis of literature according to title and abstract by two independent reviewers.
12	Analysis of literature according to full-text by two independent reviewers.
13	If there are disagreements on evidence selection, the third independent reviewer will be consulted.
14	Analysis of references from the selected studies in the full-text reading stage.
15	Data extraction and analysis according to the instrument developed by the reviewers.
16	Presentation of the obtained data.

Source: Adapted from Peters *et al.* (2020)

Appendix II

List of excluded studies after eligibility assessment based on full-text reading

List of excluded studies after eligibility assessment based on full-text reading

Exclusion code:

1 – Does not address the decannulation/decannulation process

2 – Did not have/describes rehabilitation intervention

3- Not on ICU

Year	Author	Title	Exclusion code
2016	Al Sindi, M. et al.	The impact of specialized tracheostomy care team	1
2022	Alhashemi, H., et al.	An Interdisciplinary Approach to the Management of Individuals With Tracheostomy	3
2014	Alvo, A. & Olavarría, C.	Decannulation and assessment of deglutition in the tracheostomized patient in non-neurocritical intensive care	2
2010	Ambrosino, N. & Gabbrielli, L.	The difficult-to-wean patient	2
2019	Ang, D. et al.	Optimizing energy expenditure and oxygenation toward ventilator tolerance is associated with lower ventilator and intensive care unit days	1
2022	Benito-Orejas, J.I. et al.	Results of applying a safety protocol of the patient with tracheotomy from a critical care unit	1
2014	Berney, L., et al.	Acute neurorehabilitation: Does a neurosensory and coordinated interdisciplinary programme reduce tracheostomy weaning time and weaning failure?	3
2019	Billington, J. & Luckett, A.	Care of the critically ill patient with a tracheostomy	2
2017	Bonvento, B., et al.	Role of the multidisciplinary team in the care of the tracheostomy patient	2
2014	Bösel, J.	Tracheostomy in stroke patients	1
2021	Botti, C., et al.	The Role of Tracheotomy and Timing of Weaning and Decannulation in Patients Affected by Severe COVID-19	1
2012	Bragge, P., et al.	Reviews An Overview of Published Research about the Acute Care and Rehabilitation of Traumatic Brain Injured and Spinal Cord Injured Patients	1
2020	Broderick, D., et al.	Surgical tracheostomies in COVID-19 patients: A multidisciplinary approach and lessons learned	2
2015	Brunet, J., et al.	Gestion de la décanulation : quelle prise en charge pour le patient trachéotomisé ?	1
2022	Bureau, C. & Demoule, A.	Weaning from mechanical ventilation in neurocritical care	1
2009	Cameron, T.S., et al.	Outcomes of patients with spinal cord injury before and after introduction of an interdisciplinary tracheostomy team	2
2021	Carmichael, H., et al.	Early ventilator liberation and decreased sedation needs after tracheostomy in patients with COVID-19 infection	1
2007	Caroleo, S., et al.	Weaning from mechanical ventilation: an open issue	1
2021	Carton, E., et al.	Changes in multidisciplinary tracheostomy team practice over time	3
2006	Ceriana, P., et al.	Physiological responses during a T-piece weaning trial with a deflated tube	1
2019	Ceriana, P., etal.	Noninvasive ventilation during weaning from prolonged mechanical ventilation	3
2020	Ceron, C., et al.	The Effect of Speaking Valves on ICU Mobility of Individuals With Tracheostomy	1
2009	Choate, K., et al.	Tracheostomy decannulation failure rate following critical illness: a prospective descriptive study	1
2005	Christopher, K. L.	Tracheostomy decannulation	2
2022	Clayton, N.A., et al.	The addition of respiratory muscle strength training to facilitate swallow and pulmonary rehabilitation following massive tissue loss and severe deconditioning: A case series	1
2016	Cohen, O., et al.	Feasibility of a single-stage tracheostomy decannulation protocol with endoscopy in adult patients	2
2006	Ceriana, et al.	Physiological responses during a T-piece weaning trial with a deflated tube	1

2022	Coltro, P. H., et al.	Multiprofessional instrument for tracheal decannulation in adults: content validity	2
2017	Corley, A., et al.	High-flow oxygen via tracheostomy improves oxygenation in patients weaning from mechanical ventilation: a randomised crossover study	1
2015	Credland, N.	How to remove a tracheostomy tube	2
2014	Crosbie, R., et al.	The tracheostomy clinical nurse specialist: an essential member of the multidisciplinary team	3
2020	Dawson, C., et al.	Dysphagia presentation and management following coronavirus disease 2019: an acute care tertiary centre experience	1
2022	Dawson, C., et al.	Functional Laryngeal Assessment in Patients with Tracheostomy Following COVID-19 a Prospective Cohort Study	1
2011	De Mestral, C., et al.	Impact of a specialized multidisciplinary tracheostomy team on tracheostomy care in critically ill patients	2
2017	Deransy, R., et al.	Management of tracheostomised patients in a hospital environment	2
2019	Diaz-Balve, L.P.	Respiratory muscle strength and state of consciousness values measured prior to the decannulation in different levels of complexity. A longitudinal prospective case series study	2
2017	Divo, M. J.	Post-Tracheostomy Care: Bundle Up for Success!	2
2016	Dumas, R. P. & Martin, N. D.	What's new in critical illness and injury science? Important considerations for work of breathing during tracheostomy weaning and decannulation	3
2017	Dziewas, R., et al.	Design and implementation of Pharyngeal electrical Stimulation for early de-cannulation in TRACheotomized (PHAST-TRAC) stroke patients with neurogenic dysphagia: a prospective randomized single-blinded interventional study	1
2009	Engels, P.T., et al.	Tracheostomy: from insertion to decannulation	2
2022	Faure, M., et al.	Specialized Weaning Unit in the Trajectory of SARS-CoV-2 ARDS: Influence of Limb Muscle Strength on Decannulation and Rehabilitation	3
2013	Fisher, D. F.	Tracheostomy tube change before day 7 is associated with earlier use of speaking valve and earlier oral intake	2
2007	Frank, U., et al.	Dysphagic patients with tracheotomies: A multidisciplinary approach to treatment and decannulation management	3
2011	Franke, K., et al.	Removal of the Tracheal Tube after Prolonged Mechanical Ventilation: Assessment of Risk by Oscillatory Impedance	2
2011	Freeman, S.	Care of adult patients with a temporary tracheostomy	2
2014	Frengley, J. D., et al.	Prolonged mechanical ventilation in 540 seriously ill older adults: effects of increasing age on clinical outcomes and survival	2
2006	Fukumoto, M., et al.	Ventilator weaning using a fenestrated tracheostomy tube with a speaking valve	2
2020	Gaspari, C. H., et al.	The First 60 Days: Physical Therapy in a Neurosurgical Center Converted Into a COVID-19 Center in Brazil	1
2022	Ghiani, A., et al.	Incidence, causes, and predictors of unsuccessful decannulation following prolonged weaning	2
2020	Glibbery, N., et al.	Tracheostomy in the coronavirus disease 2019 patient: evaluating feasibility, challenges and early outcomes of the 14-day guidance	2
2020	Gosselink, J., et al.	Physiotherapy for adult patients with critical illness: Recommendations of the European Respiratory Society and European Society of Intensive Care Medicine Task Force on Physiotherapy for Critically Ill Patients	1
2021	Grigoriadis, K.	Handgrip Force and Maximum Inspiratory and Expiratory Pressures in Critically Ill Patients With a Tracheostomy	1
2017	Gundogdu, I.	Implementation of a respiratory rehabilitation protocol: weaning from the ventilator and tracheostomy in difficult-to-wean patients with spinal cord injury	3
2003	Gutierrez, Charles J., et al.	Using an evidence-based protocol to guide rehabilitation and weaning of ventilator-dependent cervical spinal cord injury patients	1
2014	Hagmeyer, L., et al.	Successful weaning and decannulation after interventional bronchoscopic recanalization of tracheal stenosis	2
2020	Hakiki, B., et al.	Decannulation After a Severe Acquired Brain Injury	2
2011	Heffernan, D. S.	Impact of socioethnic factors on outcomes following traumatic brain injury	2

1995	Heffner, J. E.	The technique of weaning from tracheostomy. Criteria for weaning; practical measures to prevent failure	2
2001	Heffner, J. E. & Hess, D.	Tracheostomy management in the chronically ventilated patient	2
2005	Heffner, J. E.	Management of the chronically ventilated patient with a tracheostomy	2
2008	Heffner, J. E.	Tracheostomy decannulation: marathons and finish lines	2
2020	Herer, B.	Outcomes of Prolonged Mechanical Ventilation Before and After Implementation of a Respiratory ICU	2
2012	Hernández, G., et al.	The indication of tracheotomy conditions the predictors of time to decannulation in critical patients	2
2014	Hess, D. R. & Altobelli, N. P.	Tracheostomy tubes	2
1997	Higgins, D. M. & Maclean, J. C. F.	Dysphagia in the patient with a tracheostomy: Six cases of inappropriate cuff deflation or removal	2
2019	Holmes, T. R., et al.	Multidisciplinary Tracheotomy Teams: An Analysis of Patient Outcomes and Resource Allocation	2
2007	Hopkins, R. O., et al.	Transforming ICU culture to facilitate early mobility	1
2005	Hsu, C. L., et al.	Timing of tracheostomy as a determinant of weaning success in critically ill patients: a retrospective study	2
2005	Hunt, K. & McGowan, S.	Tracheostomy management in the neurosciences: a systematic, multidisciplinary approach	2
2022	Ishizaki, M., et al.	Tracheostomy decannulation rates in Japan: a retrospective cohort study using a claims database	2
2020	Jenkins, R., et al.	Factors associated with tracheostomy decannulation in patients with severe traumatic brain injury	2
2010	Johns, R H., et al.	Considerations and proposals for the management of patients after prolonged intensive care unit admission	2
2014	Jolley, S. E., et al.	Factors associated with receipt of physical therapy consultation in patients requiring prolonged mechanical ventilation	2
2012	Juern, J. S.	Removing the critically ill patient from mechanical ventilation	2
2018	Karim, H. R. & Yunus	Pondering for the frequency of routine single-lumen tracheostomy tube change for ongoing airway management in adult intensive care unit	2
2022	Karna, S. T., et al.	Weaning Outcomes and 28-day Mortality after Tracheostomy in COVID-19 Patients in Central India: A Retrospective Observational Cohort Study	2
2016	Kikukawa, T.m et al	H1N1 influenza-associated pneumonia with severe obesity: successful management with awake veno-venous extracorporeal membrane oxygenation and early respiratory physical therapy	1
2017	Kowalski, S., et al.	Weaning from mechanical ventilation using tracheostomy cuff deflation and a one-way speaking valve: a historical-cohort series	1
2016	Lazo, K., et al.	B35 INNOVATIONS IN MEDICAL EDUCATION: Medicine Housestaff And Nursing Knowledge Of Tracheostomy Management And Complications	2
2015	Lee, H., et al.	Safety profile and feasibility of early physical therapy and mobility for critically ill patients in the medical intensive care unit: Beginning experiences in Korea	1
2022	Lee, T., et al.	Outcomes of prolonged mechanical ventilation and tracheostomy in critically ill elderly patients: a historical cohort study	2
1995	Lee, T. S. & Wu, Y.	Bedside fiberoptic bronchoscopy for tracheostomy decannulation	2
2021	Leto, E., et al.	External validation and calibration of the decapret prediction model for decannulation in patients with acquired brain injury	2
2003	Leung, R., et al.	Decannulation and survival following tracheostomy in na intensive care unit	2
2005	Lindgren, V. A. & Ames, N. J.	Caring for patients on mechanical ventilation: what research indicates is best practice	2

2001	MacIntyre, Neil R., et al.	Section I: Guidelines: Evidence-based guidelines for weaning and discontinuing ventilatory support: A collective task force facilitated by the American College of Chest Physicians; the American Association for Respiratory Care	2
2005	MacIntyre, Neil R., et al.	Management of Patients Requiring Prolonged Mechanical Ventilation*: Report of a NAMDRC Consensus Conference	2
2015	Madsen, K. R., et al.	Danish Guidelines 2015 for percutaneous dilatational tracheostomy in the intensive care unit	2
2013	Maguire, J. M. & Carson, S. S.	Strategies to combat chronic critical illness	1
2017	Mah, J. W., et al.	Improving Decannulation and Swallowing Function: A Comprehensive, Multidisciplinary Approach to Post-Tracheostomy Care	1
2021	Mannini, A.	Data-driven prediction of decannulation probability and timing in patients with severe acquired brain injury	2
2021	Martin, K. A.	Standard versus Accelerated Speaking Valve Placement after Percutaneous Tracheostomy: A Randomized Controlled Feasibility Study	2
2000	Martins, A., et al.	Cuidados de Enfermagem ao Doente com Traqueostomia	2
2012	McGrath, B. A., et al.	Multidisciplinary guidelines for the management of tracheostomy and laryngectomy airway emergencies	2
2014	McGrath, B. A. & Wallace, S.	The UK National Tracheostomy Safety Project and the role of speech and language therapists	2
2020	McGrath, B. A., et al.	Multidisciplinary guidance for safe tracheostomy care during the COVID-19 pandemic: the NHS National Patient Safety Improvement Programme (NatPatSIP)	1
2021	Matute-Villacís, M., et al.	Role of respiratory intermediate care units during the SARS-CoV-2 pandemic	2
2015	Morris, L. L., et al.	Restoring Speech to Tracheostomy Patients	1
2014	Morris, L. L., et al.	The Importance of Tracheostomy Progression in the Intensive Care Unit	2
2021	Muhle, P., et al.	Standardized Endoscopic Swallowing Evaluation for Tracheostomy Decannulation in Critically Ill Neurologic Patients – a prospective evaluation	2
2008	Muralidhar, K.	Tracheostomy In ICU: An Insight into the Present Concepts	2
2021	Mussa, C. C., et al.	AARC clinical practice guideline: Management of adult patients with tracheostomy in the acute care setting	2
2015	Myatt, R.	Nursing care of patients with a temporary tracheostomy	2
2013	Nakashima, H., et al.	Characterizing the need for tracheostomy placement and decannulation after cervical spinal cord injury	2
2010	Nelson, J. E., et al.	Chronic Critical Illness	2
2021	Norisue, Y., et al.	Association of diaphragm movement during cough, as assessed by ultrasonography, with extubation outcome	1
2010	O'Connor, H. H. & White, A. C.	Tracheostomy decannulation	2
2020	Pancera, S. et al.	Feasibility and Efficacy of the Pulmonary Rehabilitation Program in a Rehabilitation Center: Case reporto f a young patient developing severe covid-19 acute respiratory distress syndrome	3
2015	Pires-Neto, R. C., et al.	Early mobilization practice in a single Brazilian intensive care unit	1
2015	Ponfick, M., et al.	Outcome of Intensive Care Unit-Dependent, Tracheotomized Patients with Cerebrovascular Diseases	1
2013	Prieto-González, M., et al.	Results of an artificial airway management protocol in critical patients subjected to mechanical ventilation	2
2016	Pryor, L. N., et al.	Clinical indicators associated with successful tracheostomy cuff deflation	1
2016	Pryor, L., et al.	Patterns of return to oral intake and decannulation post-tracheostomy across clinical populations in an acute inpatient setting	2
2013	Rahimi, R. A., et al.	Physical rehabilitation of patients in the intensive care unit requiring extracorporeal membrane oxygenation: A small case series	1

2021	Regan , J., et al.	Post-Extubation Dysphagia and Dysphonia amongst Adults with COVID-19 in the Republic of Ireland: a Prospective Multi-Site Observational Cohort Study	1
2018	Richard-Denis, A., et al.	The impact of a specialized spinal cord injury center as compared with non-specialized centers on the acute respiratory management of patients with complete tetraplegia: an observational study	1
2018	Ringrose, H., et al.	Association between Paroxysmal Sympathetic Hyperactivity and tracheostomy weaning in Traumatic Brain Injury	2
2010	Romero, C. M., et al.	Swallowing dysfunction in nonneurologic critically ill patients who require percutaneous dilatational tracheostomy	2
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2021	Rovira, A., et al.	Tracheostomy care and decannulation during the COVID-19 pandemic. A multidisciplinary clinical practice guideline	2
2020	Rubin, S. J., et al.	Quality improvement in tracheostomy care: A multidisciplinary approach to standardizing tracheostomy care to reduce complications	2
2014	Ruivo, M. A. & Carmo, M. C. A.	Cuidados de Enfermagem ao Cliente submetido a Traqueostomia/Traqueotomia	2
2009	Rumbach, A. F., et al	The challenges of dysphagia management and rehabilitation after extensive thermal burn injury: a complex case	2
2005	Russell, Claudia	Providing the nurse with a guide to tracheostomy care and management	2
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2017	Schneider, H., et al.	Decannulation and Functional Outcome After Tracheostomy in Patients with Severe Stroke (DECAST): A Prospective Observational Study	2
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2020	Shang, P., et al.	Mechanical ventilation in Guillain-Barré syndrome	2
2009	Skinner, E. H., et al.	Development of a physical function outcome measure (PFIT) and a pilot exercise training protocol for use in intensive care	2
2004	St. John, R. E. & Malen, J. F.	Contemporary issues in adult tracheostomy management	2
2008	Stelfox, H. T., et al.	Determinants of tracheostomy decannulation: An international survey	2
2009	Stelfox, H. T., et al.	A North American survey of respiratory therapist and physician tracheostomy decannulation practices	2
2020	Stierli, S., et al.	Insights from an interprofessional post-COVID-19 rehabilitation unit: A speech and language therapy and respiratory medicine perspective	1
2019	Stripoli, T., et al.	High-flow oxygen therapy in tracheostomized patients at high risk of weaning failure	1
2021	Tornari, C., et al.	Tracheostomy, ventilatory wean, and decannulation in COVID-19 patients	2
2018	Trouillet, J. L., et al.	Tracheotomy in ICU	2
2018	Trouillet, J. L., et al.	Tracheotomy in the intensive care unit: guidelines from a French expert panel	2
2019	Trouillet, J. L., et al.	Tracheotomy in the Intensive Care Unit: Guidelines from a French Expert Panel: the French Intensive Care Society and the French Society of Anaesthesia and Intensive Care Medicine	2
2016	Welton, C., et al.	Can an interprofessional tracheostomy team improve weaning to decannulation times? A quality improvement evaluation	2
2021	West, T. E., et al.	Pragmatic Recommendations for Tracheostomy, Discharge, and Rehabilitation Measures in Hospitalized Patients Recovering From Severe COVID-19 in Low- and Middle-Income Countries	2
2015	Wilkinson, K. A., et al.	Are we 'on the right trach?' The National Confidential Enquiry into Patient Outcome and Death examines tracheostomy care	2

Source: Prepared by the authors (2022)

Appendix III
Data Extraction Tool Complete

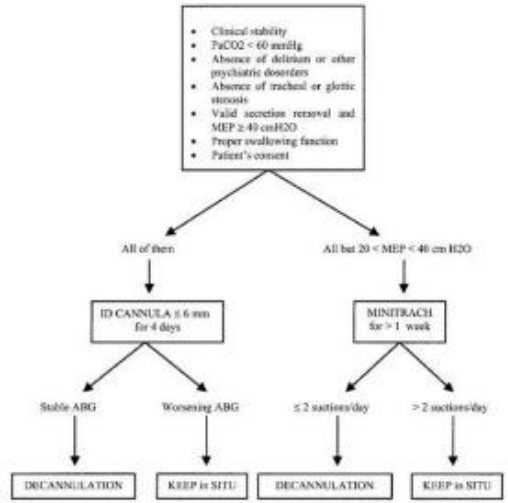
Data extraction tool complete

Author(s)	Aljedaani, Y., et al.
Publication year	2020
Place of publication/ Journal	Egyptian Journal of Hospital Medicine
Country of origin/ Publication	Saudi Arabia/ Egypt
Purpose of the study/ Research question	Apply standards for tracheostomy DEC based on the expertise of previous studies
Population size/ Recruitment context	102 patients
Methodology/ Type of study	prospective study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	DEC protocol criteria: 1. Patient conscious, oriented and responsive to verbal orders; 2. Recovery from the condition that required the performance of TT; 3. Absence of procedures that may require endotracheal anesthesia; 4. Completed ventilator weaning; 5. Ability to eliminate secretions, with the need for tracheal aspiration ≤ than 1 time per day; 6. Oxygen saturation maintained at, at least, 97% without administration of supplementary oxygen; videofluoroscopy was tested , which would have to be unchanged; 8. Present coughing ability, assessed by clearing the airways through the TT or through the upper airways (test performed after cuff deflation and occlusion of the proximal end of the TT). A PCF of at least 160 l/min was used as a reference; 9. Fibroscopy bronchoscopy was performed to ensure airway clearance at glottic and subglottic levels . 10. If all the mentioned criteria were met, the TT cannula was replaced by a fenestrated, uncuffed one. The TT was occluded (1st day - 30 min, every 3 hours, during the day; 2nd day - 12 hours; 3rd day - 24 hours). During the occlusion of the cannula, the patient's vital parameters were monitored, and any relevant alteration implied to stop the process. Patients who successfully completed this process were decannulated.
Results	DEC was successful in 97.7% of the population, who were transferred within 24 to 48 hours. DEC failed in 2.3% of patients, who were successfully decannulated on a 2nd attempt.
Main conclusions	This study demonstrates that DEC, based on objective criteria, is effective and safe, with a low failure rate.
Comments	Example of protocol, applied to 102 critically ill trauma and oncology patients. High success rate. Nurses intervention.

Data extraction tool complete

Author(s)	Bach et al.
Publication year	2014
Place of publication/ Journal	American Journal of Physical Medicine and Rehabilitation
Country of origin/ Publication	USA
Purpose of the study/ Research question	Investigate the influence of deflation of the TT cannula cuff on DEC
Population size/ Recruitment context	7 patients
Methodology/ Type of study	Observational descriptive: case studies
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	The deflated cuff allowed the passage of air to the vocal cords and phonation. This passage was compensated by reconfiguration of ventilatory parameters to maintain normal alveolar ventilation. Ventilation is now pressure-programmed to compensate for leaks (the supplied volume is now doubled). When continuous deflation was well tolerated and patients achieved (assisted or unassisted) at least 160 L/min PCF, patients were decannulated.
Results	6 out of 7 patients were decannulated (86%).
Main conclusions	According to the authors, the first step in the rehabilitation process is cuff deflation. This study emphasizes the tragic consequences of neglecting this. Caring for ventilated patient is very expensive. These costs can be minimized by decannulating patients and reintegrating them into the community, even if they remain dependent on NIV.
Comments	The DEC, allows patients to reintegrate into the community and feel less depressed, in addition to minimizing the costs of their treatment.

Data extraction tool complete

Author(s)	Ceriana, P., et al.
Publication year	2003
Place of publication/ Journal	Intensive Care Medicine
Country of origin/ Publication	Italy
Purpose of the study/ Research question	Evaluate the feasibility of following a decision flowchart to decide whether to remove the TT cannula in mechanically ventilated patients, in the long term
Population size/ Recruitment context	108 patients with successful ventilator weaning.
Methodology/ Type of study	Prospective study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**Flowchart:** 1. Clinical stability (absence of fever, sepsis or active infection) and hemodynamic stability; 2. $PaCO_2$ of less than 60mmHg; 3. Absence of delirium; 4. Absence of upper airway stenosis (assessed by bronchofibroscopy; if > 30%, were not decannulated); 5. Effective cough (sputum on demand and develop a MEP of at least 40 cmH_2O); 6. Effective swallowing (evaluation of the gag reflex, blue dye test and, when indicated, videofluoroscopy); 7. Patient consent (in the presence of family members, after explaining the risks and benefits of the procedure). When the 7 parameters were met, the internal diameter of the cannula was reduced to 6mm and it was kept capped for 3 to 4 days. Subsequently, if arterial blood gases remained constant, DEC was performed. If only criterion 5 was not met, but the MEP was around 20±39 cmH_2O, a Minitrach system was placed and maintained for at least one week. These patients were assessed daily and the effectiveness of spontaneous sputum was assessed by the ability to remove secretions without instrumental help (two or fewer suctions per day). When spontaneous sputum was achieved, the TT was removed. 
Results	78% of patients were decannulated and only 3.5% required reintubation within the first 3 months. Minitracheostomy was used as a "bridge" to DEC in eight patients, 6 due to low MEP and 2 due to swallowing problems; however, after a period of 9±3 days, the minitracheostomy was successfully removed.
Main conclusions	This flowchart focuses on the clinical assessment of physiological functions (coughing, swallowing), identifying conditions that may reduce the diameter of the upper airways (stenosis) or adherence to the procedure (delirium). It can be applied in most tracheostomized patients, however, some caution is required in specific subgroups, such as neuromuscular disease.
Comments	The vast majority of ICU patients, who are clinically stable and without the need for ventilatory support, can be decannulated, with a reintubation rate of less than 3% (in 3 months). A simple decision flowchart can be helpful in identifying which patients are ready to be decannulated.

Data extraction tool complete

Author(s)	Chan, L., et al.
Publication year	2010
Place of publication/ Journal	American Journal of critical care
Country of origin/ Publication	China/America
Purpose of the study/ Research question	Determine whether peak flow during induced cough is an adequate predictor of successful DEC.
Population size/ Recruitment context	32 patients (neurosurgical)
Methodology/ Type of study	Non-randomized controlled study??
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	The following parameters were evaluated: • higher peak expiratory flow (PEF) during 3 induced coughs; • total volume of aspirated tracheal secretions (in 6 hours); • Glasgow Coma Scale (GCS). The decision to decannulate was made by physiotherapists and physicians.
Results	23 of the 32 patients were decannulated, 2 of which required recannulation. The mean PEF rate recorded in the successful DEC group was 42.62 L/min, significantly higher than the 29.91 L/min in the unsuccessful group. Statistical interpretation indicated an optimal cut off point of 29 L/min. The mean GCS score was 9.81 for the successful group and 8.2 for the other group. The study did not find a relationship between the volume of tracheal secretions and the success/failure of DEC.
Main conclusions	Measuring peak flow rate during induced cough is a simple intervention that improves the predictability of successful DEC in neurosurgical patients. The minimum value recommended by the study is 29L/min.
Comments	Data collected and intervention performed by a respiratory physiotherapist. Neurosurgical patients. DEC with low PEF.

Data extraction tool complete

Author(s)	Costi, S., et al.
Publication year	2022
Place of publication/ Journal	International Journal of Environmental Research and public health
Country of origin/ Publication	Italy / Switzerland
Purpose of the study/ Research question	To describe patient characteristics and clinical outcomes after rehabilitation of tracheostomized patients over a period of 10 years. Compare the results achieved in 2 consecutive periods of 5 years (2010-2014 and 2015-2019). Examine associations between patient characteristics and outcomes.
Population size/ Recruitment context	180 patients
Methodology/ Type of study	Retrospective cohort study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	Interdisciplinary team: doctors, **specialized nurses**, physiotherapists, nutritionists and psychologists. 1 to 24-48 hours: Complete assessment and definition of the IRP. All patients underwent daily training for 1h, 2 times a day. The intensity was adequate to the severity of the patient on admission. Treatment included intensive physiotherapy (reinforcement of respiratory and peripheral muscles, secretion control and breathing exercises. Assisted coughing was performed in cases of neuromuscular impairment. In hypercapnic patients, positive pressure ventilation was used, with an obstructed tracheostomy. The aim of the IRP was to achieve weaning to DEC and increase the Bristol Activities score of daily Living (BADL). **DEC protocol** The patient was decannulated when: • Conscientious, oriented and collaborative; • With controlled secretions and no risk of aspiration; • No need for MV; • No need to aspirate secretions more than once a day; • No breathing difficulty with size 4 TT cannula; • Cannula occlusion test for 12 hours without respiratory difficulty and subsequent occlusion test for 24 hours.
Results	DEC rate of 45.6%. Higher number of weaned patients in the second period. 15% of patients were able to regain walking ability. Both groups improved their ability in activities of daily living (ADL's), but with greater significance in the second group. There was no significant difference in walking ability or DEC rate between the two groups. The first group had a longer weaning time. The study suggests a correlation between patient characteristics and comorbidities with the four most relevant results of rehabilitation (weaning, DEC, walking ability, improvement in ADL's). Age was associated with ability to recover in ADLs and gait. Gender was associated with improvement in ADLs. Clinical severity was associated with DEC and improvement in ADLs. With regard to diagnoses on admission, respiratory pathologies were the most prevalent and acute brain injuries were negatively associated with improvement in ADL's and walking ability.
Main conclusions	This study confirms the importance of rehabilitation in intensive weaning units for tracheostomized patients. Comorbidities and severity at admission are significantly associated with rehabilitation outcomes at discharge.
Comments	Rehabilitation program focused on weaning – implemented over 10 years in a multipurpose unit. Semi-intensive unit. Participation of specialized nursing.

Data extraction tool complete

Author(s)	Hernandez, G., et al.
Publication year	2013
Place of publication/ Journal	Intensive Care Medicine
Country of origin/ Publication	Spain/Germany
Purpose of the study/ Research question	To determine the effects of cuff deflation during MV disconnections in tracheostomized patients.
Population size/ Recruitment context	195 patients (181 completed the study; 94 with deflated cuff and 87 with inflated cuff)
Methodology/ Type of study	Randomized, single-center clinical trial.
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	The study includes all pathologies and the protocol started when they reached hemodynamic and clinical stability. Patients were subjected to high-flow oxygen therapy, connected to the TT. When this was tolerated, they were subjected to a swallowing assessment and cannula occlusion test. When there were no changes, patients were randomized into 2 groups. The group that kept the *cuff* inflated during ventilator disconnections and the group that had it deflated. **Deflated cuff group** Replacement of the cannula to a fenestrated one, with an internal diameter of 7 mm and an internal sleeve (to increase the effective diameter of the airway); **Inflated cuff group** Original cannula maintained (internal diameter of 8 mm and internal sleeve); **Weaning protocol:** • Progressive weaning from MV: intermittent attempts at spontaneous breathing with a T-piece of progressive duration (2 times/day), interspersed with periods of controlled assisted ventilation, lasting 2 hours, to allow rest; • If there were no signs of respiratory distress, the test was extended for up to 12 consecutive hours; • When the patients were able to tolerate spontaneous breathing for 12 hours, on 2 consecutive days, they began to be oxygenated by a T-piece, continuously; • Deflated group kept it that way during periods of spontaneous ventilation, while the other group kept the cuff always inflated;
Results	Patients in the deflated group received greater oxygen flow (69 vs 55 L/min), had better swallowing function (37 vs 16%) and a longer period from tracheostomy to first MV disconnection (6–10 vs 3 2–4 days). There was a trend towards lower weaning failure in the deflated group (7.4 vs. 13.8 %) and a higher rate of weaning (52 vs. 47%) and a shorter time to weaning (8 vs. 9 days). This group also had a lower percentage of respiratory infections (20 vs 36%) and a lower mortality rate (17 vs 19%). The inflated group had, however, a worse DEC success score (3.2 vs 1.1%), although all were successfully decannulated on the ward.
Main conclusions	The main finding of this study is that increasing the effective diameter of the airways (with cuff deflation) and reducing the size of the TT shortens weaning, reduces respiratory infections and improves swallowing.
Comments	Polyvalent ICU Study describes gains in weaning time, decrease in the number of respiratory infections and improvements in swallowing. It describes a greater number of patients decannulated, with greater brevity, but a slightly higher number of recannulations. Nurses participate.

Data extraction tool complete

Author(s)	Kim, D.H., et al.
Publication year	2017
Place of publication/ Journal	Spinal Cord
Country of origin/ Publication	South Korea
Purpose of the study/ Research question	To report the success of DEC/extubation in patients with cervical spinal cord injury
Population size/ Recruitment context	62 patients (60 with TT and 2 with tracheal intubation)
Methodology/ Type of study	Retrospective cohort study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**Analysis of patient files with registration of the following data:** • Demographic data; • Mechanism of injury; • American Admission Grade Spinal Injury Association (ASIA); • Presence of associated traumatic injuries, previous lung disease (tuberculosis, chronic obstructive pulmonary disease and asthma) and acute respiratory care prior to admission (intubation, TT or MV); • Evolution of the respiratory status. **Criteria for DEC:** • Alert and cooperative state; • No apparent lung disease; • No dysphagia (assessed by videofluoroscopy); • Peripheral oxygen saturations greater than 95%, without supplementary oxygen therapy; • Patent airway (assessed by fiberoscopy). **DEC process:** • TT replaced by uncuffed cannulas *with* 2 inner sleeves (fenestrated and non-fenestrated); • Occlusion of the TT, with administration of NIV (with nasal or oronasal interface); • Tracheal aspiration replaced by assisted cough (mechanical, with pressures of approximately 40cmH_2O, or manual, with abdominal pressure); • Air stacking breathing exercises (lung expansion).
Results	62 patients were decannulated/extubated after using mechanically assisted cough and NIV. The median time from TT to DEC was 7 months. Of the 60 patients with TT: • 12 did not require NIV; • 31 required continuous NIV; • 15 underwent a period of NIV but were fully weaned afterwards; • 2 were recannulated (due to development of pneumonia and recurrent airway obstruction with secretions despite performance of mechanically assisted coughing). The 31 patients with continuous NIV gradually reduced the average ventilatory support time (15.3 to 5.7h) until the end of the study.
Main conclusions	Patients with incomplete spinal cord injuries, even at a high level, can be successfully decannulated using NIV and mechanically assisted coughing.
Comments	DEC protocol with NIV in patients with spinal cord injury. It reflects the importance of mechanically and manually assisted coughing through rehabilitation.

Data extraction tool complete

Author(s)	Lemyze, M., et al.
Publication year	2022
Place of publication/ Journal	Journal of Clinical Medicine
Country of origin/ Publication	France
Purpose of the study/ Research question	To describe the application of the five D's strategy to tracheostomized, mechanically ventilated and very fragile COVID-19 survivors, first in an ICU and later in a weaning and intensive rehabilitation center.
Population size/ Recruitment context	50 patients
Methodology/ Type of study	Retrospective, single-center observational study. Design: Before and After
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**Five Ds strategy :** 1. Decrease delirium, disuse syndrome and nutritional deficiencies; 2. Ventilatory weaning; 3. Deflate the cuff; 4. Screening for swallowing disorders; 5. DEC. This strategy was started at the UCI and continued at the weaning centers as soon as step number 2 was successful for a minimum of 6 hours. An individualized physical rehabilitation program was associated with this strategy to increase and anticipate muscular, diaphragmatic and neurocognitive recovery. This program included early weaning from sedation, passive bed mobilization (with motorized movement therapy device) and active muscle exercises. It also included early rising and orthostatic position training. The program was applied twice a day, in a gym attached to the ICU.
Results	The entire sample experienced multiorgan failure (maximum SOFA score 12 (10–13)) and severe ICU-acquired neuromuscular weakness (worst MRC 17 ± 2). He also suffered from *delirium* , malnutrition and at least one superinfection. Patients were decannulated on average on the 12th day of hospitalization and on the 53rd day. They were transferred from the ICU after an average of 39 (28-58) days of hospitalization. The studied population required 25 days of intensive rehabilitation to restore autonomy in ADL's, significantly improve their aerobic capacity (6-minute walk test) and reduce vulnerability (frailty scale), anxiety and depression (hospital anxiety scale and depression). 48 of the 50 patients were discharged home.
Main conclusions	A protocol weaning strategy combined with intensive and early rehabilitation fostered an almost complete physical and mental recovery. Early rehabilitation in the ICU is recommended and safe. This study recommends the incorporation, in the ICUs, of a training room specially adapted to receive critically ill patients, which allows for physical rehabilitation in line with ventilator weaning.
Comments	Weaning and DEC protocol + early and intensive rehabilitation Respiratory ICU Implementation of the rehabilitation and weaning protocol allowed DEC of 96% of the studied sample.

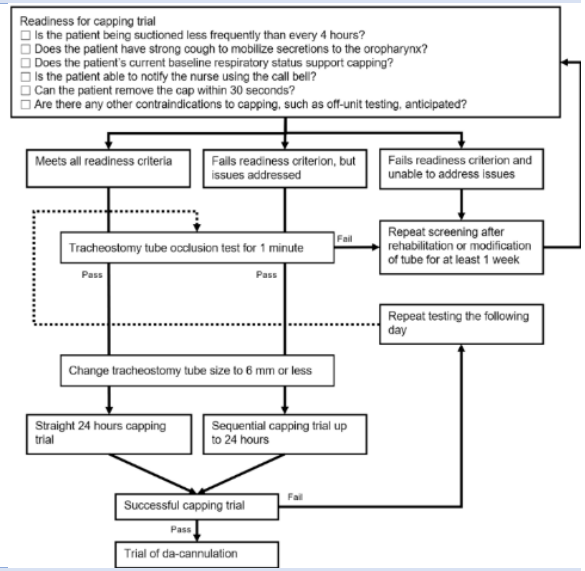
Data extraction tool complete

Author(s)	Luo, C., et al.
Publication year	2014
Place of publication/ Journal	Cell Biochem Biophys – Springer
Country of origin/ Publication	China
Purpose of the study/ Research question	To evaluate the clinical benefits of respiratory nursing interventions after TT in patients with acute traumatic cervical spinal cord injury
Population size/ Recruitment context	21 patients
Methodology/ Type of study	Retrospective study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**Respiratory nursing intervention:** 1. Criteria for occluding the TT cannula: a. Ensure humidification and heating of inspired gases; b. Aspiration of secretions; c. Effective communication. 2. Training with occluded TT cannula: a. Training with semi-occluded or transiently occluded cannula; b. When occlusion was tolerated, the cuff was deflated and the cannula occluded with a rubber device with two holes, through which humidified and heated oxygen was administered. 3. Gradually reduce the size of the TT cannula. 4. Deep breathing exercises a. Abdominal breathing training, with pursed lips (to increase tidal volume and functional residual capacity) 10 min / 3 to 4 times/day; b. Training with a breathing device (to develop more prolonged and sustained inspirations) 10 to 15 min / 2 times/ day. 5. Thoracic Physiotherapy (percussion and vibration, together with postural drainage, to eliminate secretions) a. Percussion: 5min every 4 or 6 hours; b. Vibration: 15 to 30 min / 2 times/ day. 6. Manually Assisted Cough (quad technique cough). 7. Analysis of criteria for DEC.
Results	The tracheostomy was successfully removed in 21 patients after respiratory nursing interventions. The average time from TT to DEC was 40 days. The mean time from occluded TT to DEC was 18.80 days. A single patient was recannulated after 29 days due to a respiratory infection.
Main conclusions	Training with the occluded TT cannula and manually assisted cough are preponderant factors for DEC and are developed by the respiratory nursing team. The times from TT to DEC and from occluded TT to DEC increase in "delayed" TT (>24 h) and longer MV.
Comments	This study describes the importance of respiratory rehabilitation intervention, by nurses, in tracheostomized patients with acute spinal cord injury. The study does not describe which device was used for breathing training, nor the criteria they used to decide on DEC. Nurses specialized in respiratory care intervention.

Data extraction tool complete

Author(s)	Martínez, G.H., et al.
Publication year	2020
Place of publication/ Journal	New england Journal of Medicine
Country of origin/ Publication	Spain / United States of America
Purpose of the study/ Research question	To explore the most advantageous weaning/DEC technique between a 24-hour TT occlusion test accompanied by intermittent high-flow oxygen therapy (control group) and continuous high-flow oxygen therapy with suction frequency being the indicator of readiness for DEC (group intervention).
Population size/ Recruitment context	330 randomized patients (161 in the control group, 169 in the intervention group).
Methodology/ Type of study	Randomized, multicenter study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**Weaning protocol (daily screening)** 1. Swallowing test (to assess the risk of aspiration); 2. TT cannula occlusion test (to assess airway obstruction, for 5 minutes, with cuff deflation); 3. Intermittent spontaneous ventilation training, of progressive duration, by TT, alternating with periods of assisted ventilation (at least 2 hours), to allow rest and recovery; 2 times/day 4. When patients tolerated this training for 12 hours, on 2 consecutive days, they underwent high-flow oxygen therapy, continued, through TT, with the cuff deflated. **DEC protocol** All patients received high-flow oxygen therapy when ventilating through TT. The control group intermittently (by cannula occlusion), the intervention group continuously (since there was no cannula occlusion). The parameters used were the same for both groups: temperature of 37ºC; Flow of 60Lts/min; fraction of O_2 with regular adjustment to maintain peripheral saturations between 92 and 95%. <u>Control group:</u> DEC decision based on 24-hour TT occlusion test tolerance. <u>Intervention group</u> : DEC decision based on the frequency of aspiration of secretions (when they were not aspirated more than 2 times, every 8 hours, within a 24-hour period).
Results	The time to DEC was shorter in the intervention group than in the control group (6 vs 13 days). The number of recannulated patients was higher in the control group (9 vs 4). Weaning failure was also higher in the control group (27 vs 11). The incidence of pneumonia and tracheobronchitis was lower and the length of hospital stay shorter in the intervention group than in the control group (7 vs 16 patients and 32 vs 47 patients, respectively). The length of hospital stay was longer for patients in the control group (62 vs 48 days).
Main conclusions	The DEC decision based on the aspiration frequency appears to be more efficient than the one based on the TT cannula occlusion test. According to this study, this decision had advantages in the times of DEC and hospitalization, in the susceptibility to respiratory infection and in the probability of failure in weaning and recannulation.
Comments	Protocol of ventilatory weaning and DEC, implemented, in TT patients. Polyvalent ICU The need for aspiration of secretions must be considered when designing a DEC protocol. Continuous high-flow oxygen therapy, during this weaning phase, may lead to a shorter DEC time. All parameters analyzed demonstrate advantages in DEC based on the frequency of aspiration, to the detriment of the cannula occlusion test.

Data extraction tool complete

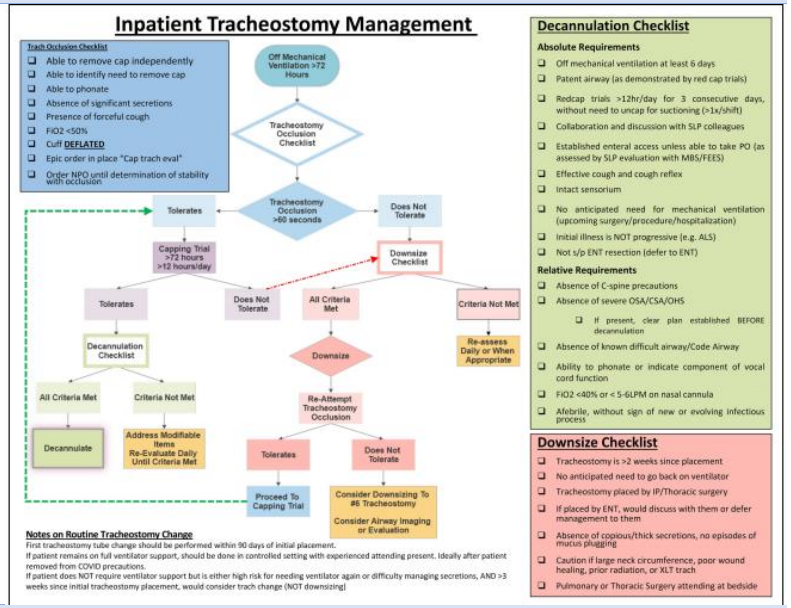
Author(s)	Park, et al.
Publication year	2021
Place of publication/ Journal	Respiratory Research
Country of origin/ Publication	South Korea / United States of America
Purpose of the study/ Research question	Evaluate factors associated with unsuccessful DEC and develop a model for predicting DEC success/failure
Population size/ Recruitment context	346 patients
Methodology/ Type of study	Retrospective cohort study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**DEC protocol (implemented by nurses specialized in respiratory care):** 1. Evaluation of readiness for the TT cannula occlusion test, with completion of a checklist; 2. Airway patency test (cuff deflation, TT occlusion, assessment of air passage in the upper airways and phonation); 3. TT cannula occlusion test (1st day: 12h occlusion and as tolerance progresses to 24h of occlusion); When patients did not tolerate the occlusion of the cannula, they underwent a reduction in the size of the cannula and reinforced physical rehabilitation); 4. DEC. 
Results	149 patients (43.1%) were successfully decannulated, 133 (89.3%) directly and 16 (10.7%) with a longer course. The main reason for the development of TT was prolonged ventilation. The mean time from intubation to TT was 9.1 days. Some variables were identified as associated with DEC failure, including: older age, higher BMI, > number of tracheal aspirations, lower PaO_2/FiO_2 ratio, comorbidities, non-ventilator causes of MV, neurological disease, delirium, need for vasopressors, pneumonia after performing TT.
Main conclusions	This study allowed the development of a predictive scoring system called DECAN, which allows predicting the success/ failure of a possible DEC.
Comments	Protocol application in polyvalent ICU, by Nurses specialized in respiratory care. DEC rate of 43.1%

Data extraction tool complete

Author(s)	Pasqua, F., et al.
Publication year	2015
Place of publication/ Journal	Multidisciplinary respiratory medicine
Country of origin/ Publication	Italy
Purpose of the study/ Research question	Validation of one TT weaning protocol and analysis of predictors of DEC success
Population size/ Recruitment context	48 patients
Methodology/ Type of study	Retrospective study?
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**Data collection** on admission: underlying disease, gasometric parameters (pH, PaO_2, $PaCO_2$, PaO_2/FiO_2), time since TT, comorbidity (Charlson comorbidity index), degree of disability (Barthel index) and presence/absence of MV. The **rehabilitation program** included: active mobilization of the limbs, electrical stimulation of the quadriceps, strengthening of the abdominal muscles, training of the respiratory muscles, strength training (cycle ergometer for the lower limbs and arm ergometer for the upper limbs) and techniques for cleaning the airways. **Weaning/DEC protocol** 1. Evaluated criteria: • Clinical stability; • Expiratory muscle strength (MEP with a portable manometer); • Absence of tracheal stenosis or granulomas (bronchofibroscopy); • Absence of swallowing disorders (laryngoscopy and videofluoroscopy); • Optimization of partial pressure of CO_2 ($PaCO_2$) and relationship between partial pressure of oxygen and fraction of inspired oxygen (PaO_2/FiO_2); 2. When all requirements were met, a fenestrated cannula was placed and occluded for a progressively longer period, up to 48 h. 3. When cough was efficient, and there were no episodes of desaturation, the patients were decannulated after 72 hours. 4. After the observation period, the patients were divided into two groups: decannulated (D) and non-cannulated (ND).
Results	28 patients were decannulated (58.3%). Gender, cause of admission, Barthel index and blood gas parameters were not statistically associated with DEC results. Younger patients had a higher DEC rate. Only 45% of patients with lung diseases were decannulated as opposed to 86% of patients with non-pulmonary diseases. 86% of non-ventilated patients were decannulated versus 37% of ventilated patients. The average pH value, which was significantly higher in D (pH 7.43) compared to ND (pH 7.40). PaO_2 was lower in D (45.6) than in ND (47.1). The time of TT, before rehabilitation, was significantly lower in D (2 months) compared to ND (3 months and 23 days).
Main conclusions	The success of the rehabilitation program was lower in ventilated patients, with pulmonary disease and with HT for more than 10 weeks. Non-ventilated patients were almost 10 times more decannulated than ventilated patients. Patients with non-pulmonary diseases were 7 times more decannulated. Patients with TT for less than 10 weeks were 6 times more likely to be decannulated.
Comments	Validation of DEC protocol associated with rehabilitation program – polivalent ICU (excluding neuromuscular patients) Protocol is based on objective assessment of expiratory muscle strength, cough, absence of dysphagia, granulomas or stenosis, good saturation and normocapnia. Longer TT periods are associated to greater difficulty in successfully decannulating. Earlier implementation of the rehabilitation process and protocol, is associated with better efficiency of DEC.

Data extraction tool complete

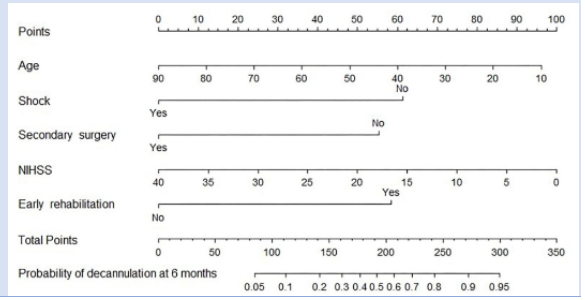
Author(s)	Sood, R.N., et al.
Publication year	2021
Place of publication/ Journal	Journal of Intensive Care Medicine
Country of origin/ Publication	USA
Purpose of the study/ Research question	Evaluate the results of performing a TT on patients with Covid-19
Population size/ Recruitment context	37 patients
Methodology/ Type of study	Case series
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	Performance of TT when patient is intubated and mechanically ventilated for a long time. **DEC protocol** (multidisciplinary – respiratory physiotherapy, nursing, pulmonology, thoracic surgery, intensive care): 1. Weaning from MV, 72h; 2. Assessment by speech therapist and respiratory physiotherapist (swallowing, vocalization and unidirectional valve); 3. Occlusion test for 5 min (upper airway occlusion screening) 4. TT occlusion 12h/ day – 3 consecutive days; 5. DEC. Patients who did not tolerate the TT occlusion, reduce the cannula caliber.
Results	33 patients were weaned from MV (89%) and 18 were decannulated (48%). The mean time from TT to DEC was 26 days. No health professional was infected with covid-19.
Main conclusions	TT facilitates weaning from MV, reduces the length of stay in ICU.
Comments	Small sample. Protocol implemented in respiratory patients, with participation of nurses.



Data extraction tool complete

Author(s)	Thomas, S., et al.
Publication year	2017
Place of publication/ Journal	European journal of physical and rehabilitation medicine
Country of origin/ Publication	Germany
Purpose of the study/ Research question	To describe DEC times and associated risk factors, in chronic critical patients, with ICU acquired weakness (ICUAW)
Population size/ Recruitment context	122 TT patients with ICU disuse syndrome (excluding neurological and neuromuscular patients)
Methodology/ Type of study	Cohort study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	All patients received an individual plan of physiotherapy, occupational therapy and other therapies. Decannulation decision – multidisciplinary: neurologist, otorhinolaryngologist, internal medicine, speech therapist. **Predictive variables studied:** • Barthel Index; • Clinical severity (Early Rehabilitation Barthel Index and Apache II); • Number of catheters (urinary catheter, nasogastric tube and/or TT on admission); • Muscle strength (sum of upper limb: shoulder, elbow, and wrist) (sum of lower limb: hip, knee, and ankle) using Medical Research Council (MRC); • Grip strength (sum of both hands - dynamometer); • Assessment of functional status (FSS-UCI); • Physical Function ICU Test (PFIT-s); • Pain (numerical pain scale); • Sitting and standing balance (“the function reach” expressed in cm); • Cognitive assessment (Montreal Cognitive Assessment - MoCA); • Clock Drawing Test (CDT).
Results	DEC after a mean of 40.5 days and a median of 89 days after the onset of primary disease. The study describes two main risk factors for DEC: the number of medical tubes (catheters) on admission and the duration of ventilator weaning in days.
Main conclusions	Predicting the timing of DEC supports medical decision-making in rehabilitation and can provide a prognosis for DEC. The number of medical tubes and duration of ventilator weaning can influence DEC.
Comments	Despite having a less significant statistical relationship, a higher MS's MRC score and a higher FSS-ICU score may be predictors of greater safety and success in DEC. DEC protocol in post-acute ICU and rehabilitation units.

Data extraction tool complete

Author(s)	Wang, X., et al.
Publication year	2022
Place of publication/ Journal	Frontiers in Neurology
Country of origin/ Publication	China / United States of America
Purpose of the study/ Research question	To explore predictive factors of DEC in patients with neurological damage, 6 months after performing TT. Build a new model for clinical diagnosis and treatment.
Population size/ Recruitment context	367 patients
Methodology/ Type of study	Retrospective observational study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	Patients divided into 2 groups: decannulated and cannulated. **Data collected on admission:** • Demographic data (age, sex, history of alcohol or tobacco consumption, chronic diseases); • Clinical data (main diagnosis, NIHSS Score and GCS, pupillary reactivity, complications in the last 6 months, surgery, early rehabilitation – 1st week of hospitalization – or late); • TT data (cannula diameter, trachea diameter, date of its performance, date of DEC, adverse events). **DEC protocol** (based on the one developed by Ceriana et al., 2003; when it was possible to meet the satisfaction of the following criteria): • Clinical stability; • $PaCO_2$ < 60mmHg; • Absence of delirium; • Normal endoscopic examination (or stenosis < 30%); • Ability to clear the airways (sputum when requested or generate a maximum expiratory pressure of 40 cmH_2O); • Swallowing without compromise (gag reflex, blue dye test and videofluoroscopy); • Cannula diameter reduced to 6 mm and its occlusion for 3 to 4 days, with gasimetric stability.
Results	147 patients (40.1%) were decannulated within 6 months (mean – 89 days). 27 (19.1%) were dysarthric, 25 (17%) had swallowing disorders, 2 (1.4%) had difficulty healing the stoma and 19 (12.9%) developed aspiration pneumonia. Of the variables studied, those that revealed a statistical relationship with the probability of DEC were: • Age; • Score of National Institutes of Health Stroke Scale (NIHSS); • Early rehabilitation; • Shock; • Secondary surgery. **Nomogram:** 
Main conclusions	Developed a nomogram to predict the probability of DEC at 6 months in patients with neurological damage. The nomogram includes the variables that revealed statistical implications for DEC: age, NIHSS score, early rehabilitation, shock and secondary surgery. The application of this nomogram can help physicians to estimate the patients prognosis.
Comments	Neurocritical ICU Development of nomogram, predictor of DEC. The data obtained in this study reinforced the evidence that early rehabilitation, which included progressive peripheral muscle training, breathing exercises, electronic neuromuscular stimulation, speech therapy and swallowing training, was feasible and decisive for the success of DEC.

Data extraction tool complete

Author(s)	Zhou, T., et al.
Publication year	2022
Place of publication/ Journal	Journal of Intensive care
Country of origin/ Publication	China
Purpose of the study/ Research question	To evaluate the feasibility of a standardized DEC protocol, implemented by a pulmonary rehabilitation team, in patients with prolonged TT referred to a rehabilitation hospital.
Population size/ Recruitment context	92 patients
Methodology/ Type of study	Prospective cohort study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	All patients undergo physical and pulmonary rehabilitation (airway clearance training, respiratory muscle training and physical training). **DEC protocol** **Step 1:** • Clinical stability; • Weaning from MV for more than 48 hours. **Step 2:** • Speech valve tolerance (to identify upper airway obstruction). **Step 3:** • Maintenance of the speech valve, progressively, for up to 4 hours, without the need for tracheal aspiration. **Step 4:** • Clinical evaluation; • Assessment of PCF and PEF (if greater than 100 L/min and 1.67 L/s, respectively, the patient was considered capable of coughing); • DEC. Swallowing was evaluated, but the result did not interfere with the decision to decannulate, only with the choice of the feeding method. DEC failure was considered when there was a need for reintubation or recannulation within 48 hours after DEC.
Results	Of the 92 patients, 57 (62%) met the criteria for DEC. 56 had successful DEC and 1 was recannulated 10h after DEC (98.2% success rate). The mean duration of TT maintenance was 70.6 days. The average number of days from admission to DEC was 42.7. No recannulation or reintubation was performed until 3 months after DEC.
Main conclusions	It is concluded that this DEC protocol, implemented by an interdisciplinary rehabilitation team, is associated with high success rates. The assessment of upper airway patency was central to the success of this protocol, even without invasive assessment. The team used the speaking valve tolerance in place of the TT occlusion test. Swallowing assessment was indicative of feeding mode but, did not play a deliberative role in the DEC protocol.
Comments	Application of DEC protocol in polyvalent ICU. Study with high success rates. Speaking valve application instead of TT occlusion test. Participation of cardiopulmonary rehabilitation nurses.

Data extraction tool complete

Author(s)	Zivi, I., et al.
Publication year	2018
Place of publication/ Journal	Frontiers in Neurology
Country of origin/ Publication	Italy / United States of America
Purpose of the study/ Research question	To assess whether an early rehabilitation protocol, initiated in ICU, helps to reduce the duration of TT, in patients with Acquired Brain Injury
Population size/ Recruitment context	66 patients (40 for the Early Rehabilitation Group and 26 for the Late Rehabilitation Group)
Methodology/ Type of study	Retrospective Study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**Early rehabilitation group** (rehabilitation in the acute phase, from the 1st week) **Late rehabilitation group** (rehabilitation in the sub-acute phase). Sessions of 60 min/ day: mobilization in bed, sensorial stimulation and verticalization training (ErigoR scale - Hocoma, Switzerland). **DEC protocol:** 1. Patient is alert; 2. Able to tolerate TT occlusion for more than 24 hours (with $SpO_2 > 95\%$); 3. Few secretions, no need for aspiration (effective cough); 4. No alteration of the upper airways (bronchofibroscopy). 5. DEC.
Results	Both groups had the same rate of decannulated patients (70%). Only one patient, from the delayed rehabilitation group, was recannulated, 9 days after DEC. Patients in the Early Rehabilitation Group were decannulated sooner (61.0 vs. 94.5 days and shorter ICU stay (30.0 vs. 52.0 days). The length of stay in the ICU was considerably shorter for the early group (30 vs. 52 days).
Main conclusions	Neurorehabilitation protocol, implemented in patients with severe acquired brain injury, makes it possible to reduce the time until DEC and ICU admission.
Comments	Rehabilitation in the acute phase is safe and translates into favorable outcomes for patients when compared with the same training started at a later stage of their treatment.

Data extraction tool complete

Author(s)	Bach & Saporito
Publication year	1996
Place of publication/ Journal	Chest
Country of origin/ Publication	USA
Purpose of the study/ Research question	Prospectively compare parameters that can predict successful extubation and successful DEC
Population size/ Recruitment context	49 patients (62 extubation/DEC attempts)
Methodology/ Type of study	Observational???
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**Criteria to undergo the extubation/DEC protocol:** • Clinical stability; • Apyretic, with normal value of white blood cells (without administration of antibiotics); • Cognitively healthy and cooperative (without administration of sedative or narcotic drugs); • Able to maintain a PaO_2 > 60mmHg, peripheral O_2 saturation > 92% and a normal $PaCO_2$. Vital capacity was measured before and after extubation/DEC. Patients underwent spontaneous breathing tests. CFP were also measured, with assisted and unassisted cough. **Protocol:** • Changing the ventilatory mode from controlled to assisted; • Weaning from O_2 administration (maintaining adequate oxygenation); • Change of TT cannula to a fenestrated one, with cuff; • Occlusion of the TT cannula, with administration of NIV (with intermittent positive pressure); • When patient is comfortable and stable with the TT occluded, proceed with DEC, maintaining assisted coughing; • Patients were instructed to remain monitored and, when there was desaturation, they should perform assisted ventilation or assisted cough, manually or mechanically (pressures used: from +30 to +50 and -30 to -50 cmH_2O, with inflated cuff, with aid of abdominal compression); • Patients who failed the 1st attempt at DEC, underwent respiratory muscle training with air stacking maneuver.
Results	49 DEC attempts were performed in 37 patients. 25 were successful in the 1st attempt, 12 failed and, in subsequent attempts, 7 were successful and 5 failed. All patients with an orotracheal tube were successfully extubated. After DEC, 26 patients required NIV, which they maintained for an average of 19.8 to 21.6 months. All patients with PCF > 160L/min were successfully extubated/decannulated. Statistical analysis of the results indicates that PCF is the only independent predictor of successful DEC and the existence of an important correlation between ventilation time through TT and successful DEC in patients with spinal cord injury. Patients whose DEC failed underwent laryngofibroscopy to assess possible obstructions and, when necessary, underwent corrective surgery.
Main conclusions	Assisted CPF and duration of ventilation requirement may predict successful extubation/DEC in patients with compromised neuromuscular function. Weaning centered on non-invasive monitoring and respiratory muscle training techniques can be effective in decannulating/extubating patients. DEC/extubation allowed patients to have more comfort, to feel more secure and confident with their image, in addition to allowing phonation and improvements in swallowing. The authors also refer that DEC/extubation allowed to reduce costs with the treatment of these patients.
Comments	Article searched from citations. Protocol application, polyvalent group of patients. Reference article, cited many times on the subject.

Data extraction tool complete

Author(s)	Enrichi et al.
Publication year	2017
Place of publication/ Journal	Respiratory care
Country of origin/ Publication	Italy
Purpose of the study/ Research question	Evaluate which clinical parameters are predictive of successful DEC, in patients with acquired brain injury
Population size/ Recruitment context	74 patients
Methodology/ Type of study	Cross-sectional study
Rehabilitation intervention (decannulation procedure; evaluation and monitoring)	**DEC protocol:** • Presence and effectiveness of voluntary cough (assessed with a spirometer, > 160L/min); • Positive cough reflex test (at least 2 coughs, provoked with nebulized cough-inducing agent); • TT cannula capped tolerance for 72 hours, with breathing through the upper airways; • Effective swallowing (instrumental evaluation through fibroendoscopy, with liquid and food administration); • Negative blue dye test (aspiration screening); • Assessment of the number of aspirations of tracheal secretions (if there are more than 2 aspirations every 8 hours, the patient was not decannulated); • Assessment of airway clearance (through endoscopy); • O_2 saturation of 95%, without administration of supplementary oxygen; • GCS ≥ 8. All patients were evaluated 48h after DEC.
Results	57 patients were decannulated (77%). Of these 57, 3 (5%) had a negative evaluation up to 48 hours and were recannulated (2 due to tracheomalacia and 1 due to vocal cord paresis). The parameters that proved to be most significant in the success of DEC were the tolerance of the TT capping, airway patency (endoscopy), effective swallowing and the blue dye test.
Main conclusions	The study suggests that a single test for DEC decision could be developed, based on the evaluation of the parameters that were more sensitive to its success. The results of this study also reveal that voluntary coughing may not be a criterion as decisive as demonstrated in previous studies. The amount of secretions was presented as sensitive and specific, but the researchers decided not to emphasize its importance, justifying it with the subjectivity of the act of aspiration being performed by different professionals.
Comments	Article searched from citations. Protocol application in neurocritical ICU. High weaning rate. Exclude aspiration of secretions for an invalid reason? It seems little interventional from the point of rehabilitation.

Source: Prepared by the authors (2023)

Appendix IV
Supplementary material

Table 1 – Vocabulary for defining the research question and PCC

	Terms under study	**MeSH / DeCS**	**Natural language**
Participants	Patients with tracheostomy	Tracheostomy	Respiratory stoma
Concept	Decannulation		Decannulation; Tracheostomy weaning; Tracheostomy removal; Tracheostomy decannulation.
Context	ICU	Critical care; Intensive care; Intensive care unit; Intensive care units; ICU; Critical illness.	

Source: Prepared by the authors (2023)

Table 2 – Key terms for building the boolean expression

Boolean Operators	**AND**			
	Concept 1	Concept 2	Concept 3	Concept 4
OR	1 – **Tracheostomy;**	2 – **Rehabilitat*;** 3 - Rehabilitation nurs*;	4 – Decannulation; 5 - Tracheostomy weaning; 6 - Tracheostomy removal; 7 - Tracheostomy decannulation; 8 - Decannulation protocol; 9 - Tracheostomy decannulation protocol; 10 – Tracheostomy rehabilitation	11 – **Critical care;** 12 – Intensive care; 13 - **Intensive care unit***; 14 – ICU; 15 – **Critical Illness;** 16 – Critical Ill*;
	A: 1	B: 2 or 3	C: 4 or 5 or 6 or 7 or 8 or 9 or 10	D: 11 or 12 or 13 or 14 or 15 or 16
A and B and C and D				

Source: Prepared by the authors (2023)

Table 3 – Boolean expression search results

Database	Boolean expression
MEDLINE via PubMed	Application strategy of the Boolean expression can be consulted in table 4
CINAHL® Complete via EBSCOhost	Application strategy of the Boolean expression can be consulted in table 5
Nursing & Allied Health Collection via EBSCOhost	Application strategy of the Boolean expression can be consulted in table 6
Cochrane Database of Systematic Reviews via EBSCOhost	Application strategy of the Boolean expression can be consulted in table 7
MedicLatina via EBSCOhost	Application strategy of the Boolean expression can be consulted in table 8
Scopus®	("tracheostom*") AND ("decannulation" OR "Tracheostomy removal" OR "Tracheostomy weaning" OR "Tracheostomy decannulation" OR "Decannulation protocol" OR "Tracheostomy decannulation protocol" OR "Tracheostomy rehabilitation") AND ("critical car*" OR "Intensive car*" OR "intensive care unit*" OR "ICU*" OR "Critical illness" OR "Critical Ill")
Web Of Science	
ProQuest	("tracheostomy") AND ("decannulation") AND ("critical care")
RCAAP	(Título) Decanulação OU (Título) Descanulação OU (Título) Traqueostomia
OpenGrey	("tracheostom*") AND ("decannulation" OR "Tracheostomy removal" OR "Tracheostomy weaning" OR "Tracheostomy decannulation" OR "Decannulation protocol" OR "Tracheostomy decannulation protocol" OR "Traqueostomy rehabilitation") AND ("critical car*" OR "Intensive car*" OR "intensive care unit*" OR "ICU*" OR "Critical illness" OR "Critical Ill")
MedNar	
Academic Google	

Source: Prepared by the authors (2023)

Table 4 – Medline search strategy via PubMed

Line Code	Search terms	Results
# 17	#14 AND #15 AND #16	693
# 16	#7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13	5.768
# 15	#1 OR #2 OR #3 OR #4 OR #5 OR #6	653.783
# 14	Tracheostomy [MeSH Terms]	8.614
# 13	Tracheostomy rehabilitation	1.260
# 12	Tracheostomy decannulation protocol	114
# 11	Decannulation protocol	187
# 10	Tracheostomy decannulation	1.283
# 9	Tracheostomy removal	1.392
# 8	Tracheostomy weaning	982
# 7	Decannulation	2.964
# 6	Critical Ill*	63.495
# 5	Critical Illness [MeSH terms]	37.213
# 4	ICU	169.705
# 3	Intensive care unit* [MeSH terms]	102.373
# 2	Intensive Care	611.740
# 1	Care, critical [MesH terms]	65.205

Source: Prepared by the authors (2023)

Table 5 – CINAHL® complete research strategy, via EBSCOhost

Line Code	Search terms	Results
S17	S1 AND S15 AND S16	68
S16	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15	90.366
S15	S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8	575
S14	AB critical ill*	4.655
S13	AB critical illness	4.498
S12	AB ICU	31.584
S11	AB intensive care unit*	54.190
S10	AB intensive care	64.085
S9	AB critical care	17.944
S8	AB tracheostomy rehabilitation	0
S7	AB tracheostomy decannulation protocol	0
S6	AB decannulation protocol	16
S5	AB tracheostomy decannulation	47
S4	TX tracheostomy removal	18
S3	TX tracheostomy weaning	51
S2	AB decannulation	526
S1	AB tracheostomy	3.790

Source: Prepared by the authors (2023)

Table 6 – Nursing & Allied Health Collection research strategy, via EBSCOhost

Line Code	Search terms	Results
S17	S1 AND S15 AND S16	8
S16	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15	13.969
S15	S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8	119
S14	AB critical ill*	561
S13	AB critical illness	553
S12	AB ICU	4.021
S11	AB intensive care unit*	7.157
S10	AB intensive care	8.995
S9	AB critical care	4.004
S8	AB tracheostomy rehabilitation	0
S7	AB tracheostomy decannulation protocol	0
S6	AB decannulation protocol	3
S5	AB tracheostomy decannulation	9
S4	TX tracheostomy removal	7
S3	TX tracheostomy weaning	5
S2	AB decannulation	111
S1	AB tracheostomy	591

Source: Prepared by the authors (2023)

Table 7 – Research Strategy Cochrane Database of Systematic Reviews, via EBSCOhost

Line Code	Search terms	Results
S17	S1 AND S15 AND S16	2
S16	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15	459
S15	S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8	2
S14	AB critical ill*	27
S13	AB critical illness	27
S12	AB ICU	137
S11	AB intensive care unit*	328
S10	AB intensive care	426
S9	AB critical care	40
S8	AB tracheostomy rehabilitation	0
S7	AB tracheostomy decannulation protocol	0
S6	AB decannulation protocol	0
S5	AB tracheostomy decannulation	1
S4	TX tracheostomy removal	0
S3	TX tracheostomy weaning	0
S2	AB decannulation	2
S1	AB tracheostomy	24

Source: Prepared by the authors (2023)

Table 8 – MedicLatina research strategy, via EBSCOhost

Line Code	Search terms	Results
S17	S1 AND S15 AND S16	3
S16	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15	2148
S15	S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8	14
S14	AB critical ill*	34
S13	AB critical illness	24
S12	AB ICU	606
S11	AB intensive care unit*	1.516
S10	AB intensive care	1.792
S9	AB critical care	151
S8	AB tracheostomy rehabilitation	0
S7	AB tracheostomy decannulation protocol	0
S6	AB decannulation protocol	2
S5	AB tracheostomy decannulation	1
S4	TX tracheostomy removal	0
S3	TX tracheostomy weaning	2
S2	AB decannulation	12
S1	AB tracheostomy	87

Source: Prepared by the authors (2023)

A elaboração da *scoping review* encontra-se em formato de artigo, tendo já sido redigido em inglês, de forma a posteriormente ser adaptado às normas de uma revista para submeter a publicação.

5. PROTOCOLO DE ATUAÇÃO DE REABILITAÇÃO NA DESCANULAÇÃO DO DOENTE CRÍTICO

Atualmente, verifica-se uma falta de consistência nos cuidados da TQ, sendo a evidência sobre recomendações clínicas escassa, o que implica uma elevada taxa de morbidade e mortalidade e um custo significativo para o Sistema Nacional de Saúde. Nesse sentido, urge a criação de protocolos de atuação de reabilitação na descanulação do doente crítico, que padronizem as intervenções dos profissionais de saúde, e onde estejam explanadas as linhas orientadoras para a prestação de cuidados específicos. Estes protocolos visam reduzir as taxas de complicações associadas a este tipo de cuidados, sendo igualmente determinantes para a educação e treino das equipas interdisciplinares que participam no cuidado aos doentes com TQ (Rubin et al., 2020).

De facto, os doentes críticos devem ser sujeitos a uma avaliação inicial, realizada pela equipa de reabilitação. O objetivo dessa avaliação é obter informações detalhadas sobre a condição física, cognitiva e funcional do doente, a fim de desenvolver um plano de reabilitação adequado e personalizado. Assim, os procedimentos discriminados na figura 3 deverão ser realizados durante a avaliação inicial (Costi et al., 2022; Jin et al., 2021; Kim et al., 2017; Pasqua et al., 2015; Reid et al., 2018; X. Wang et al., 2022; Y. T. Wang et al., 2022; Wright et al., 2018).

Com base nos resultados obtidos, a equipa de reabilitação desenvolve um Programa de Reabilitação Individualizado (PRI), estabelecendo metas realistas e determinando as intervenções necessárias. Esse plano pode incluir cinesiterapia respiratória, treino de tosse, treino respiratório (com recurso a dispositivo eletrónico), treino muscular (com recurso a cicloergómetro e ergómetro de braço), levante precoce, treino de verticalização, electroestimulação (dos membros inferiores, superiores e musculatura abdominal) e exercícios de reabilitação neurocognitiva.

É importante ressalvar que a avaliação inicial efetuada pela equipa de reabilitação nas UCI's deverá transpor-se para um processo contínuo e dinâmico, pois a condição do doente pode alterar-se inesperadamente e de forma célere. Por exemplo, a prontidão para a descanulação deve ser avaliada diariamente (Mehta & Mehta, 2017). Nesse sentido, a equipa de reabilitação deverá realizar avaliações periódicas para reavaliar o progresso do doente e ajustar o PRI conforme necessário. Após a avaliação inicial e definição do PRI, este deve ser implementado, de forma síncrona com a aplicação da estratégia dos 5 D's (**D**iminuição do *delirium*, síndrome de desuso e deficiências nutricionais; **D**esmame ventilatório; **D**esinsuflação do *cuff*; **D**espiste de alterações da deglutição; **D**escanulação) (Lemyze et al., 2022).

Com o intuito de facilitar a implementação do PRI, foi criada pela autora um documento onde constam os domínios que devem ser avaliados pelo EEER quando o mesmo se encontra a planear o PRI (figura 3).

Avaliação inicial do EEER para planeamento do PRI

Anamnese	Entrevista com doente (se consciente) ou familiares para obter informações sobre: historial médico, sintomas prévios, habilidades funcionais e nível de independência antes do internamento.
Exame físico	Avaliar estado geral: função cardiorrespiratória, força muscular, mobilidade, amplitude de movimento das articulações, equilíbrio e coordenação.
Avaliação respiratória	Verificar a função pulmonar, presença de dificuldades respiratórias e necessidade de suporte ventilatório.
Avaliação neurológica	Avaliar o nível de consciência, a função cognitiva, o controlo motor e a sensibilidade.
Avaliação funcional	Avaliar a capacidade para realizar AVDs.
Avaliação da deglutição e da fala	Avaliar a capacidade de deglutir alimentos (nas várias consistências), o risco de aspiração e a função da fala
Avaliação psicossocial	Considerar o impacto emocional e psicológico do internamento, no doente e na família

Figura 2: *Avaliação inicial do EEER para planeamento do PRI*

Além disso, foi ainda elaborado pela autora uma *checklist* referente à avaliação dos doentes com TQ integrados em PRI, que deve ser preenchida diariamente, à cabeceira do doente (Figura 4).

***Checklist* de avaliação dos doentes com TQ integrados em PRI**

□ Desmame da VM	□ Estabilidade clínica/hemodinâmica
□ ECG___ (O__; V__; M__)	□ Avaliação de *delirium*____
□ PFT___Lt/min	□ Avaliação da dor _____
□ Aspiração SB (n.º/24h) ___	□ Cânula de TQ: Calibre____mm /
□ Deglutição eficaz	□ Fenestra
□ MRC: _____ MSD: P____/D___	□ Cuff
MSE: P____/D___	□ Data de colocação__/__/____
MID: P____/D___	□ VM □ VNI □ ONAF □ VE
MIE: P____/D___	□ Tempo de oclusão tolerado_____min/h

Data: __/__/____

Legenda: MSD – membro superior direito; MSE – membro superior esquerdo; MID – membro inferior direito; MIE – membro inferior esquerdo; P – proximal; D – distal; VE – ventilação espontânea

Figura 3: *Checklist de avaliação dos doentes com TQ integrados em PRI*

De facto, a consciência do doente é um dos pontos determinantes para o sucesso da descanulação, pelo que a avaliação da Escala de Coma de Glasgow (ECG) deve ser realizada diariamente. No que concerne à força muscular, esta deve ser avaliada com recurso à "*Medical Research Council Muscle Scale*" (MRC) e nos quatro membros, adaptando-se esta avaliação, naturalmente, à condição física do doente. Sugere-se ainda que a avaliação do *delirium* seja realizada com recurso à "Lista para a verificação do *delirium* em cuidados intensivos", que se encontra traduzida e validada para a língua portuguesa (Abelha et al., 2013). A redução do calibre da TQ deve ser realizada apenas 14 dias após a sua realização (Sood et al., 2021). No sentido de operacionalizar este processo, foi elaborado um esquema do protocolo sugerido, que pode ser consultado na figura 5.

Protocolo de atuação de reabilitação para a descanulação da TQ

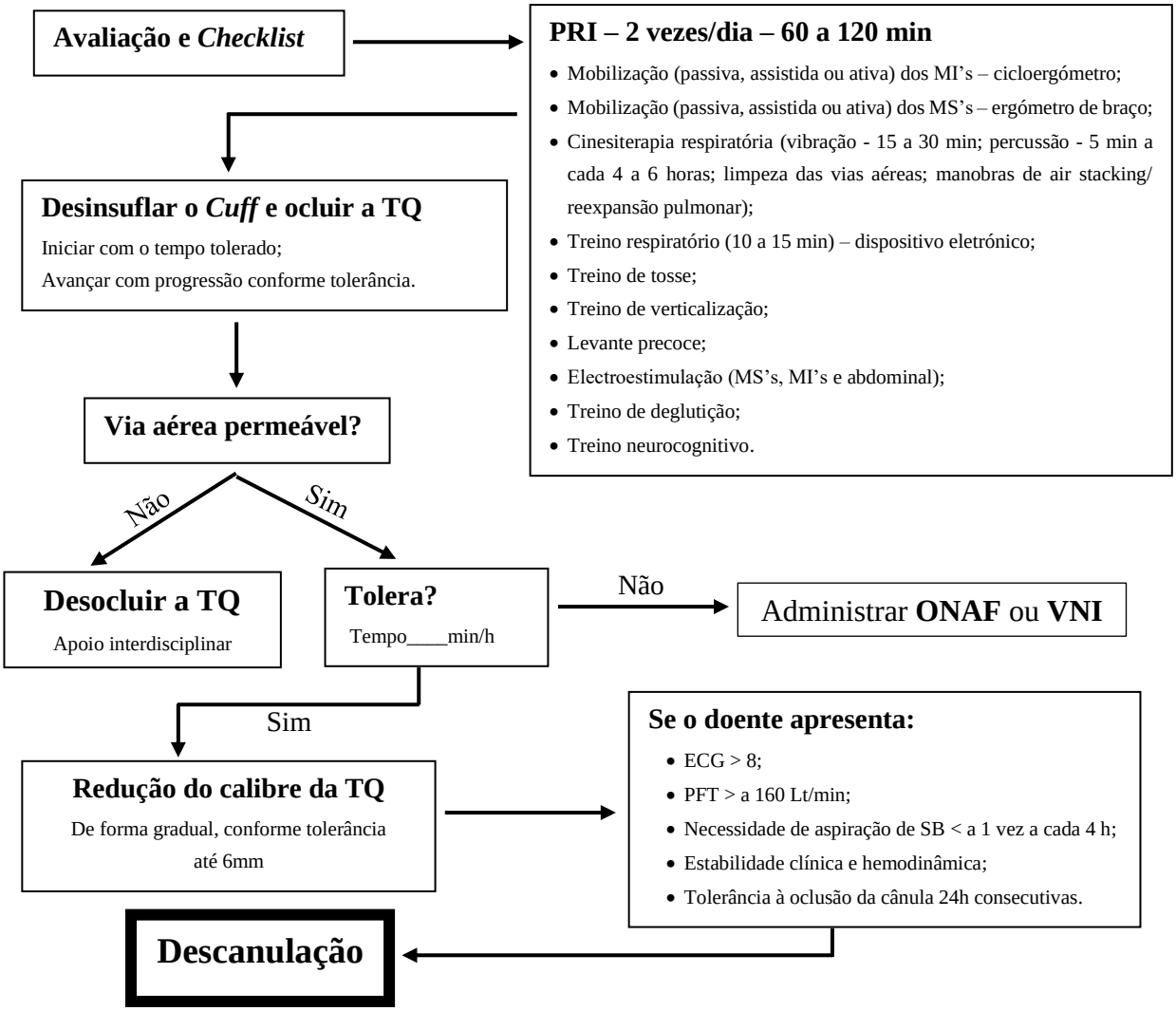


Figura 4: *Protocolo de atuação de reabilitação para a descanulação de TQ*

De salientar que a aplicação da *checklist* e do protocolo, não devem descurar os registos cuidados e precisos das intervenções executadas nos sistemas de informação disponibilizados nos contextos da prática clínica.

A Enfermagem, enquanto disciplina, deve criar registos explícitos e claros da sua atuação e dos ganhos obtidos com a mesma (Paiva, 2006). Assim, para uma melhoria da qualidade e fiabilidade dos indicadores passíveis de ser criados e uma diminuição do tempo despendido nos registos, criamos uma compilação dos diagnósticos e intervenções de enfermagem que suportam esta *checklist* e protocolo de atuação, sendo que os mesmos foram desenvolvidos com base na ontologia de enfermagem (Ordem dos Enfermeiros, 2021) (figura 6 e figuras 7a-7j).

Diagnósticos de Enfermagem sugeridos no processo de descanulação:

1. Parésia
2. Potencial para melhorar consciencialização da relação entre os exercícios músculo-articulares e a força muscular
3. Potencial para melhorar capacidade para executar exercícios músculo-articulares
4. Dor
5. Comunicação verbal expressiva comprometida
6. Ventilação (comprometida)
7. Limpeza das vias aéreas (comprometida)
8. Potencial para melhorar consciencialização da relação entre a tosse e a limpeza da via aérea
9. Potencial para melhorar capacidade para limpar secreções da via aérea
10. Traqueostomia
11. Erguer-se (comprometido)
12. Potencial para melhorar consciencialização sobre compromisso no erguer-se
13. Potencial para melhorar capacidade para erguer-se
15. Transferir-se (comprometido)
16. Potencial para melhorar consciencialização sobre compromisso no transferir-se
17. Potencial para melhorar capacidade para transferir-se
18. Potencial para melhorar conhecimento sobre autogestão do regime de exercício
19. Potencial para melhorar consciencialização da relação entre exercício físico e tolerância à atividade

Figura 6 – *Diagnósticos de Enfermagem sugeridos no processo de descanulação*

Consciência (comprometida)	Avaliar evolução da consciência;
	Executar técnica de imaginação guiada;
	Executar técnica de distração;
	Executar técnica de orientação para a realidade.

Figura 7a – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "consciência"*

Dor	Avaliar dor;
	Gerir analgesia;
	Aplicar frio;
	Aplicar calor;
	Executar técnica não farmacológica para alívio da dor;
	Executar massagem.

Figura 7b – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "dor"*

Parésia	Avaliar evolução da força - movimento muscular;
	Avaliar evolução do tónus muscular;
	Executar técnica de exercício músculo-articular passivo;
	Executar técnica de exercício músculo-articular ativo-assistido;
	Executar técnica de exercício músculo-articular ativo-resistido.
Potencial para melhorar consciencialização da relação entre os exercícios músculo-articulares e a força muscular	Potencial para melhorar consciencialização da relação entre os exercícios músculo-articulares e a força muscular;
	Potencial para melhorar consciencialização da relação entre os exercícios músculo-articulares e a força muscular;
	Potencial para melhorar consciencialização da relação entre os exercícios músculo-articulares e a força muscular.
Potencial para melhorar capacidade para executar exercícios músculo-articulares	Instruir exercícios músculo-articulares;
	Treinar exercícios músculo-articulares.

Figura 7c – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "parésia"*

Limpeza da via aérea comprometida	Avaliar evolução da limpeza da via aérea;
	Aspirar a via aérea;
	Posicionar para facilitar a limpeza da via aérea;
	Executar técnica de mobilização de secreções das vias aéreas;
	Executar técnica da tosse assistida.
Potencial para melhorar consciencialização da relação entre a tosse e a limpeza da via aérea	Avaliar evolução da consciencialização da relação entre a tosse e a limpeza da via aérea;
	Analisar com o cliente a relação entre tosse e limpeza da via aérea.
Potencial para melhorar capacidade para limpar secreções da via aérea	Avaliar evolução da capacidade para limpar secreções da via aérea;
	Instruir técnica da tosse;
	Treinar técnica da tosse;
	Instruir a usar dispositivo de promoção da limpeza da via aérea;
	Treinar a usar dispositivo de promoção da limpeza da via aérea.

Figura 7d – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "limpeza das vias aéreas"*

Comunicação verbal expressiva comprometida	Avaliar evolução da comunicação verbal;
	Implementar estratégias facilitadoras da comunicação;

Figura 7e – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "comunicação verbal expressiva"*

Ventilação comprometida	Avaliar evolução da ventilação;
	Posicionar para otimizar a ventilação;
	Executar exercícios de controlo respiratório;
	Executar técnica de reexpansão torácica;
	Executar técnica respiratória abdomino-diafragmática;
	Executar exercícios de fortalecimento muscular respiratório.

Figura 7f – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "ventilação"*

Traqueostomia	Avaliar evolução da TQ;
	Executar cuidados à TQ;
	Trocar cânula externa de TQ;
	Insuflar cuff;
	Desinsuflar cuff;
	Avaliar a pressão do cuff;
	Tapar cânula de TQ;
	Destapar cânula de TQ.

Figura 7g – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "traqueostomia"*

Erguer-se comprometido	Avaliar evolução do erguer-se;
	Assistir no erguer-se
Potencial para melhorar consciencialização sobre compromisso no erguer-se	Avaliar evolução da consciencialização sobre compromisso no erguer-se;
	Assistir o cliente na autoavaliação do erguer-se.
Potencial para melhorar capacidade para erguer-se	Avaliar evolução da capacidade para erguer-se;
	Instruir a erguer-se;
	Treinar a erguer-se.

Figura 7h – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "erguer-se"*

Transferir-se comprometido	Avaliar evolução do transferir-se;
	Assistir no transferir-se;
	Transferir o cliente;
	Transferir o cliente usando dispositivo.
Potencial para melhorar consciencialização sobre compromisso no transferir-se	Avaliar evolução da consciencialização sobre compromisso no transferir-se;
	Assistir o cliente na autoavaliação do transferir-se.
Potencial para melhorar a capacidade para transferir-se	Avaliar evolução da capacidade para transferir-se;
	Instruir a transferir-se;
	Treinar a transferir-se.

Figura 7i – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "transferir-se"*

Potencial para melhorar conhecimento sobre autogestão do regime de exercício	Avaliar evolução do conhecimento sobre autogestão do regime de exercício;
	Ensinar sobre regime de exercício;
	Ensinar sobre autogestão do regime de exercício;
	Ensinar sobre intensidade e duração do exercício físico;
	Ensinar sobre exercício físico.
Potencial para melhorar consciencialização da relação entre exercício físico e tolerância à atividade	Avaliar evolução da consciencialização da relação entre exercício físico e tolerância à atividade;
	Analisar com cliente a relação entre exercício físico e tolerância à atividade.

Figura 7j – *Intervenções de Enfermagem sugeridas no processo de descanulação, tendo em consideração o foco "autogestão do regime de exercício"*

CONSIDERAÇÕES FINAIS

Os enfermeiros assumem-se, cada vez mais, como um elemento essencial nas organizações de saúde, enfrentando um número crescente de desafios. Nesse sentido, necessitam de dar resposta às mudanças verificadas nos cuidados de saúde, assim como às pressões demográficas, garantindo o acesso a mais e melhores recursos tecnológicos, de forma a corresponder às expectativas dos cidadãos. Assim, e no sentido de acompanhar estes desafios, tem-se assistido à evolução da profissão, da disciplina e da ciência de Enfermagem. Como resultado, os enfermeiros necessitam de encontrar respostas para a mudança de práticas, o que só é possível com a aquisição de novas competências, por meio da formação profissional avançada.

O papel do enfermeiro especialista, no seio de uma equipa interdisciplinar, é valorizado por competências na documentação dos cuidados de enfermagem, excelência no exercício profissional, capacidade de liderança e implementação de projetos para melhorar a qualidade assistencial, formação e assessoria da gestão (Regulamento n.º 140/2019: Competências Comuns Do Enfermeiro Especialista, 2019). De facto, o EEER pode ajudar a melhorar as respostas aos problemas de saúde das populações. Este documento reitera isso, demonstrando a importância de uma prática baseada na melhor evidência, o que contribui para a melhoria da prestação de cuidados, da formação, da gestão e da investigação. Ressalva-se a importância do trabalho do EEER na identificação de necessidades, na recolha de dados, na realização de pesquisa e no desenvolvimento de estudos de investigação (Regulamento n.º 392/2019: Competências Específicas Do Enfermeiro Especialista Em Enfermagem de Reabilitação, 2019).

Como já foi explanado em capítulos anteriores, o contributo e o valor da intervenção do EEER no contexto das UCI's está relacionado com algumas características definidoras do seu papel, tais como: a importância das habilidades na recolha de dados, do desenvolvimento de diagnósticos, e na capacidade de interpretar e avaliar a complexidade das necessidades em cuidados de reabilitação. Destaca-se, ainda, o valor da criação de planos de intervenção adaptados à natureza e ao caminho da transição vivenciado pela pessoa em situação crítica, para que possam recuperar mais rapidamente, com o menor número de riscos possível, evitando desta forma complicações e eventos adversos.

Consideramos, como elemento fulcral deste capítulo, a reflexão sobre o sentimento experienciado e narrado na introdução deste trabalho e que se relaciona com

a vivência do período pandémico, em ambiente de UCI. Esta experiência fortaleceu a identificação da importância e da complexidade dos cuidados prestados à pessoa em situação crítica, bem como do papel do EEER na criação e implementação de planos de reabilitação individuais, realistas e ajustados às condicionantes vivenciadas. Atualmente, os EEER precisam ter uma ampla compreensão do campo da enfermagem, baseada numa análise da sua filosofia. Isso permitirá compreender como o pensamento da enfermagem evoluiu como profissão, disciplina e ciência. De facto, a adoção da identidade de classe conduz a responsabilidades e obrigações disciplinares, profissionais e sociais, com o intuito de viabilizar a construção de uma verdadeira ontologia em enfermagem, traduzindo numa representação formal do conhecimento de forma a atender aos padrões de qualidade.

Por outro lado, salienta-se que o envelhecimento populacional é uma realidade incontornável, pelo que o número de doentes críticos em UCI tem vindo a elevar-se, bem como as taxas de sobrevivência (Paiva et al., 2016). No entanto, do nosso conhecimento, existe pouca evidência sobre as consequências físicas e psicossociais que enquadram o contexto desta sobrevivência. As preocupações éticas e sociais necessárias para as boas práticas em conformidade com a evidência científica são determinadas pelos limites do cuidado à pessoa em situação crítica e pela preocupação com a reintegração social dos sobreviventes (Paiva et al., 2016). Como resultado, é necessário tomar decisões com a melhor qualidade, eficácia e eficiência, devido ao aumento dos custos com os cuidados prestados a doentes internados em UCI.

Nesse sentido, a TQ é um procedimento comumente realizado em doentes com dificuldades respiratórias, sendo que a descanulação é um marco significativo no processo de recuperação desses doentes, pois indica a restauração da função respiratória normal. Efetivamente, os custos económicos e sociais com o cuidado de um doente a reinserir-se na comunidade, com ou sem TQ, são significativamente diferentes, pelo que a otimização e descanulação de um doente previamente à sua alta hospitalar pode facilitar exponencialmente a sua reinserção na comunidade (Lehmann et al., 2019; Stieglitz & Randerath, 2012; Windisch et al., 2010). Conclui-se ainda que a descanulação deve ser preferencialmente realizada num ambiente mais controlado e com recursos humanos mais diferenciados, como os são disponibilizados em UCI (Blondonnet et al., 2014; Fernandez et al., 2008, 2011). Não obstante, a decisão de descanular um doente deve ser baseada numa avaliação clínica abrangente, que inclua a análise da condição pulmonar, a

capacidade de respirar e tossir de forma eficaz, a estabilidade hemodinâmica e a capacidade de proteger as vias aéreas superiores.

No cuidado ao doente crítico, o EEER desempenha um papel fundamental, pelo que este estudo pretende ser um contributo para a sua afirmação e validação. De facto, o EEER acompanha o doente crítico em todo o percurso relacionado com a ventilação, desde a preparação para a entubação até à extubação, confeção de TQ e posterior descanulação. Nesse sentido, foi desenvolvido um trabalho de identificação de necessidades e através do qual se concluiu que não existe concordância quanto ao procedimento a tomar face à reabilitação de um doente com TQ, com vista a uma descanulação bem-sucedida.

Efetivamente, um doente crítico em UCI com TQ experiencia uma diversidade de mudanças relacionadas com a imobilidade imposta pela sua condição de saúde, pelo que estas devem ser alvo de atenção pelo EEER, podendo ser representadas, sob o olhar da ontologia em enfermagem, pelos seguintes focos: compromisso na consciência, na ventilação, na limpeza das vias aéreas, no autocuidado e na comunicação verbal expressiva. Este tipo de doentes pode igualmente desenvolver condições relacionadas com a diminuição da força muscular, como a parésia ou dor. Os potenciais do conhecimento e da capacidade do doente, nos mais variados fenómenos, devem ser avaliados e alvo de intervenção, na medida em que a compreensão e a colaboração do doente desempenham um processo facilitador na transição de saúde-doença (Meleis et al., 2000). Nesse sentido, a formulação de diagnósticos de enfermagem, assim como a prescrição e a implementação de intervenções de enfermagem, assim como a recolha e a organização de dados, e a própria definição de resultados, deve, desta forma, desenvolver-se com base nessa mesma orientação (Martins et al., 2018). De facto, a prática clínica, quando suportada por referenciais teóricos, acaba por ter um guia de orientação que viabiliza uma ação sistematizada, resultando numa maior eficácia e eficiência dos cuidados prestados (Martins et al., 2018). Assim, como pilar de sustentação para a construção desta dissertação de mestrado, baseamo-nos no referencial teórico de Afaf Meleis e da sua Teoria das Transições (Meleis et al., 2000).

Face ao exposto anteriormente, compreende-se a imperatividade da criação deste estudo, onde se assume a representação do processo de desenvolvimento de uma revisão do tipo *scoping*. Os estudos incluídos nesta revisão não apresentam a participação de EEER na sua totalidade, facto que se explica ao longo do desenvolvimento deste trabalho e que se prende com o número reduzido de EEER existente no mundo e no minorado

número de projetos de investigação desenvolvidos por estes profissionais (Mendes & Nunes, 2018).

O pilar estrutural desta investigação foi a orientação da metodologia utilizada: JBI® para revisões *scoping*. Optou-se por redigir o protocolo e a *scoping review* em formato de artigo, numa perspetiva de disseminar os resultados desta investigação de forma mais robusta, uma vez que se irão constituir como fontes de evidência primária.

A *scoping review* desenvolvida centra-se em 19 artigos que abordam a descanulação do doente crítico, sendo que, como resultado da mesma, identificamos a recomendação da criação de uma equipa interdisciplinar para a abordagem a esta tipologia de doentes. Recomenda-se, também, uma avaliação cuidada e diária, prévia à descanulação, de particularidades como o nível de consciência, a dependência de ventilação mecânica, a capacidade de tossir, a necessidade de aspiração traqueal, a capacidade de deglutição, a permeabilidade das vias aéreas superiores e a estabilidade hemodinâmica e clínica. Nesse sentido, as intervenções sugeridas são: a redução do calibre das cânulas de TQ, o esvaziamento do cuff e a implementação de PRI's. Estes últimos devem incluir: treino muscular generalizado, com especial enfoque nos músculos respiratórios; a utilização de aparelhos eletrónicos para treino respiratório; a utilização de aparelhos motorizados para treino no leito; e a utilização de eletroestimuladores. A importância da cinesioterapia respiratória também é destacada, com foco no treino da tosse e na limpeza das vias aéreas. Além disso, destaca-se a importância da associação de administração de ONAF ou VNI na descanulação, para garantir o seu sucesso.

Após a análise cuidada e rigorosa dos resultados obtidos, desenvolvemos a sugestão de um protocolo de reabilitação, com o objetivo de descanular o doente crítico de forma eficaz e segura. De facto, os protocolos são uma ferramenta útil para uniformizar os cuidados, sendo que vários autores defendem que o DV deve ser orientado pelos mesmos (Fan et al., 2017; MacIntyre, 2001; Willden, 2019). Esta prática permite que o doente crítico deixe de necessitar, de forma mais precoce, da VMI, o que permite que o DV ocorra de forma mais célere e segura (Fan et al., 2017; MacIntyre, 2001). Uma das recomendações publicadas, prende-se com a sugestão da implementação desses protocolos por profissionais de saúde não médicos: os protocolos de DV devem ser implementados por profissionais com experiência em reabilitação respiratória e que acompanhem de forma próxima o doente, como sendo o EEER (Fan et al., 2017; Haas & Loik, 2012; MacIntyre, 2001).

O protocolo criado pela autora representa o resultado da análise de toda a evidência científica encontrada. Não obstante, em virtude do conhecimento se encontrar em constante mutação, este, como qualquer outro protocolo, poderá sofrer alterações no futuro. Assim, a autora compilou essa informação e tentou seguir uma sequência lógica, que se narra como a avaliação inicial do doente e o preenchimento de uma *checklist* diária, a implementação do PRI, a desinsuflação do cuff e oclusão da TQ, a diminuição do calibre da mesma, a reavaliação do doente e, finalmente, a descanulação.

O conhecimento empírico, que é narrado ao longo deste documento, representa apenas uma parte do padrão de conhecimentos fundamentais necessários para prestar cuidados especializados em reabilitação ao doente crítico com TQ. No entanto, a experiência clínica e profissional deve ser tida em consideração para o exercício de uma prática eficiente, dada a complexidade da natureza das respostas humanas. Além disso, a incorporação de elementos de conhecimento pessoal e moral pode ser promotor de práticas extremamente benévolas, que estão em conformidade com as exigências sociais e ético-deontológicas da profissão.

Este estudo apresenta algumas limitações. A primeira encontra-se relacionada com a inexperiência da autora na realização de revisões da literatura. No entanto, assume-se que esta foi ultrapassada, tendo em consideração o empenho e o investimento da autora principal, tendo igualmente contribuído para este facto a orientação disponibilizada pela equipa pedagógica. Outra limitação prende-se com o número reduzido de evidências encontradas sobre esta temática, o que sugere que é mandatário a realização de um maior número de estudos na área da reabilitação em UCI. De facto, a investigação é o motor impulsionador de qualquer profissão, pelo que é através desta via que os profissionais de enfermagem na área de reabilitação poderão demonstrar o seu contributo específico e insubstituível para ganhos em saúde na discussão da qualidade dos cuidados de saúde, nomeadamente, determinar as diretivas e condições para os serviços de enfermagem alcançarem os padrões da qualidade (Gomes et al., 2014). O tipo de artigos encontrados também foi uma limitação deste estudo, nomeadamente aqueles cujo contexto diferia do considerado no critério de inclusão (UCI, nível III), e que poderiam conter informações potencialmente relevantes para este estudo. Aquando da realização do protocolo, a autora desconhecia a realidade das unidades de desmame especializado e, por isso, os estudos realizados nestes locais foram metodologicamente excluídos. A última limitação deste estudo está relacionada com o uso de filtro linguístico, o que poderá ter limitado ainda mais os artigos identificados. Assim, o número de artigos eliminados por este motivo e a

facilidade de acesso a ferramentas de tradução levam a concluir que, numa futura investigação, não se utilizará este tipo de filtro restritor.

Em suma, poder-se-á assumir que os resultados obtidos e narrados neste estudo são profícuos para a orientação da prática do EEER. Recomendamos que estes profissionais sejam impulsionadores de mais pesquisa e investigação, na área da enfermagem de reabilitação em UCI. Um dos estudos sugeridos envolve a avaliação do PFT recomendado para a descanulação, uma vez que nos deparamos com uma elevada disparidade nos valores recomendados nos estudos primários. Pressupõe-se que a implementação do protocolo delineado permitirá que a descanulação se realize de forma mais célere e bem-sucedida, reduzindo desta maneira as consequências nefastas para o doente e os custos com o seu tratamento. Assim, é nosso objetivo proceder à implementação do mesmo, de forma a validar a sua eficiência. Esta nova investigação permitirá não só definir os intervalos de tempo, bem como adequar o número de repetições na implementação do PRI, uma vez que os estudos primários são omissos nestas sugestões.

Desta forma, concluímos que foram atingidos os objetivos propostos com o desenvolvimento deste trabalho. Esperamos ainda que o resultado desta dissertação de mestrado aprofunde a compreensão neste campo de estudo e inspire o desenvolvimento de pesquisas adicionais sobre a descanulação do doente crítico em UCI.

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