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ABRAMEDE
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O Jornal Brasileiro de Medicina de Emergência (JBMEDE) inicia a sua história como mais um marco na consolidação da jovem especialidade de Medicina de Emergência no Brasil e ratifica um dos pilares da Associação Brasileira de Medicina de Emergência (ABRAMEDE) como força motriz e difusora do conhecimento da especialidade no país. O periódico nasce com periodicidade trimestral, um corpo editorial fortemente associado à área e revisores comprometidos com a geração e prática baseada nas melhores evidências científicas. Com orgulho, a ABRAMEDE constrói ações em prol do desenvolvimento da educação médica permanente, fortalecimento da especialidade e contínua melhoria das práticas assistenciais

CONTATO:

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Editorial

Estamos fechando as janelas de tempo no pronto-socorro?

Are we closing time windows in the Emergency Department?

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Na cidade de São Paulo, passamos, atualmente, pelo processo de referenciamento dos Serviços de Emergência públicos. Isso significa que, ao invés do paciente ter acesso direto a qualquer Serviço de Emergência público, os serviços são classificados hierarquicamente, de forma que os serviços primários permitiriam acesso direto e os secundários e terciários (e quaternários), não. Esses serviços hierarquicamente superiores receberiam pacientes por meio da Central de Regulação de Ofertas e Serviços de Saúde (CROSS).

Esse processo busca organizar de maneira hierárquica os diferentes serviços de pronto-socorro do município. Um dos argumentos para esse tipo de estruturação é o de que o próprio Sistema Único de Saúde (SUS) já prevê, em suas diretrizes organizacionais,[1,2] a hierarquização do sistema, em que os pacientes devem realizar seu seguimento no local de complexidade adequada para seus problemas de saúde. O outro argumento é o de que limitar a entrada de pacientes em serviços complexos auxiliará no problema da superlotação dos pronto-socorros. Os hospitais que têm então esse modelo de pronto-socorro referenciado (ou emergência referenciada) não possuem uma triagem para todos os pacientes que procuram atendimento nesse local e nem estruturas que facilitam a entrada de qualquer pessoa no pronto-socorro.

Durante meu estágio na sala de emergência dentro de um serviço referenciado, atendemos uma paciente do sexo feminino de pouco mais de 60 anos, admitida como uma parada cardiorrespiratória. Foi feita hipótese diagnóstica de tromboembolismo pulmonar por achados ao exame físico, ao ultrassom *point-of-care* e a partir de dados de história. Após trombólise e 1 hora e 30 minutos de ressuscitação cardiopulmonar, a paciente evoluiu a óbito. Familiares informaram posteriormente que a paciente aguardara entre 45 minutos e 1 hora para acessar o pronto-socorro, sendo autorizada a entrar somente quando ficou arresponsiva.

Casos como esse devem nos fazer refletir se a hierarquização do sistema de saúde e esse método de referenciamento podem ser aplicados em um pronto-socorro. Por todo o Brasil, vemos situações de superlotação dos Serviços de Emergência – principalmente os públicos. A superlotação é um problema grave, no qual ocorre um desequilíbrio entre a demanda dos pacientes, a capacidade de funcionamento do Departamento de Emergência e os leitos disponíveis para os pacientes que

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precisam ser internados. Existe um alto número de pacientes que necessitam dos Serviços de Emergência, dos recursos humanos e de espaço físico, e a saída do Departamento de Emergência ainda é limitada pela pouca disponibilidade de leitos para receber pacientes. A literatura mostra que a superlotação aumenta o risco de erros e eventos adversos graves, compromete a privacidade do paciente, gera aumento de insatisfação de pacientes e familiares, chegando eventualmente à agressividade, além de ser um ambiente hostil para equipe, contribuindo para afastamentos e *burnout*.

O referenciamento seria uma estratégia válida para corrigir esse problema e organizar os fluxos dos pacientes? Na nossa formação como emergencistas, aprendemos uma ampla variedade de doenças que são tempo-sensíveis e para as quais atrasos no tratamento acarretam maior morbimortalidade e impedem que a melhor terapia possa ser aplicada. Será então que um paciente que procura um serviço terciário/quaternário pode ser orientado a ir para outro local, baseado em uma avaliação sumária sem realizar uma triagem e o atendimento inicial? Todos os pacientes, acometidos por diversas doenças que atendemos, toleram percorrer o sistema hierarquizado, com seus tempos de espera para regulação e de transporte entre unidades, até chegar ao seu local com recurso adequado para seu tratamento? Será que a melhor solução da superlotação é a limitação de entrada de pacientes aos Serviços de Emergência?

Sabemos como o pronto-socorro é um ambiente marcado pela incerteza e pela necessidade da exclusão de diagnósticos de gravidade. Ele também é um ambiente repleto de pacientes, sendo necessária uma ótima formação, para identificar aqueles com doenças tempo-sensíveis que demandam condutas mais assertivas e imediatas. Mesmo em casos triados fora da sala de emergência, com fichas que seria classificadas como azuis, verdes e amarelas pelo Sistema Manchester de Classificação de Risco, é frequente encontrarmos pacientes com dor torácica atípica que é infarto, urticária que é anafilaxia, falta de ar que é tromboembolismo pulmonar, dor de cabeça que é uma hemorragia intracraniana ou, ainda, dificuldade para andar que é, na verdade, acidente vascular cerebral.

O sistema de referenciamento e hierarquização pressupõe que pacientes seriam atendidos primeiro na unidade periférica do SUS para ter uma suspeita diagnóstica, a qual, então, seria usada para o sistema de referenciamento do CROSS para solicitação dos recursos necessários para seu tratamento. Parece um sistema harmonioso. No entanto, para alguns acometimentos muito graves, um dos recursos necessários é justamente o tempo. Esse sistema, para conseguir realizar seus encaminhamentos, consome tempo. O paciente com acidente vascular cerebral isquêmico tem uma janela de 270 minutos a partir do início dos sintomas para indicação de trombólise. A indicação é complexa e a habilidade para realizá-la não é disponível nas unidades periféricas. Sabemos, ainda, que quanto mais precoce, melhor o prognóstico para o paciente. O mesmo é válido para o infarto agudo do miocárdio (tempo limite de 12 horas, a partir dos sintomas, para revascularização), mas cujo prognóstico de tratamento com 3 a 6 horas é muito melhor. O manejo da sepse grave é complexo, e o atendimento inicial e manejo nas primeiras horas têm importância sobremaneira no prognóstico, principalmente daqueles com choque séptico. Hemorragia cerebral com necessidade de tratamento cirúrgico tem janela de ação curta. Se o reconhecimento das algumas condições graves não for ágil e a terapia de suporte não for iniciada, o paciente pode evoluir para um ciclo vicioso de piora hemodinâmica e disfunção de múltiplos órgãos que nenhum referenciamento será capaz de reverter. No sistema de referenciamento, é necessário o tempo para regulação e transporte para o centro de referência, e colocamos em cheque a oportunidade de tratamento do paciente, aumentando o risco de morbidade sequelar e, eventualmente, mortalidade.

Diante desse cenário, voltamos à pergunta inicial: É adequado colocar o pronto-socorro em um sistema hierarquizado? A paciente que exemplificamos chegou com uma patologia grave, e seu desfecho poderia ter sido diferente, caso o fluxo facilitasse a entrada para sua triagem e atendimento? Espero que possamos contribuir para uma nova reflexão da hierarquização e referenciamento de pronto-socorros.

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Revisão de Tema

JBMEDE
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O desafio da mensuração da bainha do nervo óptico: uma revisão da literatura

The challenge of measuring the optic nerve sheath: a literature review

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RESUMO

A hipertensão intracraniana está relacionada a taxas mais altas de mortalidade, e sua correta identificação pode ser definidora de prognóstico. O uso do ultrassom da bainha do nervo óptico tem sido feito para manejo precoce dessa condição, mas apresenta divergências na literatura acerca de sua padronização. As faixas utilizadas como ponto de corte da dilatação da bainha do nervo óptico são heterogêneas, de acordo com a patologia, características do paciente e tempo de mensuração. Por meio desta revisão de literatura, verificamos que muitos falsos resultados podem ser obtidos por medidas diferentes, sendo o ultrassom do nervo óptico uma ferramenta a ser utilizada por profissionais experientes. para garantir melhor acurácia do método e maior fidedignidade às terapias empíricas, a partir das mensurações.

Descritores: Nervo óptico; Hipertensão intracraniana; Ultrassom

ABSTRACT

Intracranial hypertension is related to higher mortality rates and its correct identification can determine prognosis. Optic nerve sheath measurement with ultrasound is used in the early management of this condition, but there are differences in the literature regarding its standardization. We observe that the ranges used as the cutoff point for optic nerve sheath dilation are heterogeneous according to the pathology, patient characteristics, and time of measurement. Through this literature review, we have observed that many false results can be obtained by different measures, with optic nerve ultrasound being a tool to be used by experienced professionals to ensure better accuracy of the method and greater reliability of empirical therapies based on its measurement.

Keywords: Optic nerve; Intracranial hypertension; Ultrasonics

INTRODUÇÃO

A hipertensão intracraniana (HIC) pode ser causada por condições neurológicas e não neurológicas e está associada a piores desfechos e a maiores taxas de mortalidade.[1] A identificação do paciente com essa condição é definidora de prognóstico, e seu manejo altera a história natural da doença.

A suspeita da HIC é feita pelo quadro clínico do paciente. O paciente pode se apresentar com cefaleia, rebaixamento do nível de consciência e vômitos. Os sinais incluem alterações do VI par craniano, papiledema, equimose periorbitária espontânea e a tríade de Cushing: bradicardia, depressão respiratória e

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hipertensão. Os exames de imagem podem mostrar sinais que sugerem HIC, como apagamento de sulcos, redução dos ventrículos cerebrais e desvio de linha média. No entanto, a realização de exames de imagem tem como desvantagem a necessidade de transportar o paciente até o setor de tomografia ou ressonância. A monitorização padrão-ouro da pressão intracraniana (PIC), inclusive nos pacientes vítimas de trauma, é feita de maneira mais acurada por meio de um cateter intracerebral. Esse procedimento nem sempre é factível em ambiente de pronto-socorro, pois traz consigo muitos riscos inerentes a sua inserção, como infecções e sangramentos, além do alto custo para sua realização.[2]

Na HIC, a pressão é transmitida para o espaço subaracnóideo, consequentemente dilatando a bainha do nervo óptico (uma continuação da camada meníngea que recobre o nervo óptico), devido ao acúmulo de fluido cerebroespinhal nas fibras do nervo, podendo inclusive apresentar expansões em seu diâmetro em tempo real de acordo com mudanças na PIC.[2-4] Essa propriedade é detectável pelo ultrassom, que apresenta correlação indireta com a HIC. É uma forma útil para se determinar a HIC à beira leito de maneira rápida, não invasiva e com baixo custo.[1,5-7]

A definição do valor normal do diâmetro da bainha ou ponto de corte para HIC é um grande desafio que vem sendo estudado há anos, tanto em indivíduos saudáveis adultos quanto em animais. Essa dificuldade se deve tanto pelos dispositivos ultrassonográficos nem sempre fornecerem uma boa qualidade de imagem quanto pelos desafios da qualidade técnica de janelamento e mensuração das estruturas, principalmente por se tratar de medidas pequenas. Outro fator que pode atrapalhar a mensuração é o efeito *blooming*, que acontece quando o ganho da tela gera imagens com falsas interpretações acerca dos limites de uma estrutura – no caso, da bainha do nervo óptico. Esse efeito tem levado à baixa objetividade e à menor efetividade do método, mas pode ser corrigido com ajustes corretos do brilho da tela.[1]

As distinções encontradas entre as várias referências sobre os valores de normalidade do diâmetro da bainha se devem à diferentes populações estudadas, além das limitações dos aparelhos utilizados para realizar o procedimento, incluindo o posicionamento do transdutor no globo ocular.[2] A identificação de HIC pelo ultrassom à beira do leito pode levar a medidas medicamentosas e, até mesmo, cirúrgicas invasivas, expondo o paciente ao risco de um tratamento empírico, sendo necessário que o uso da ferramenta traga boa acurácia, com alta sensibilidade e, principalmente, alta especificidade. Um dos pontos que podem contribuir para resultados menos acurados é a inexperiência do examinador ou o treinamento limitado em realizar o exame, sendo importante frisar que um único valor como ponto de corte não possibilita determinar a HIC.[5] Considera-se que cerca de 17 a 25 exames são necessários para considerar o examinador proficiente na técnica.

Outro fator que limita a acurácia do método é a realização do exame com o paciente de olhos fechados, pois não é possível definir o posicionamento correto da mirada enquanto o transdutor examina o globo ocular. Por esse motivo, as medidas podem não ser precisas em algumas situações, como é o caso da mirada extrema, em que o corte do nervo óptico se dá de forma oblíqua, tornando a mensuração super ou subestimada. Essa dificuldade poderia ser resolvida realizando o exame com os olhos abertos por meio de anestésicos tópicos e garantindo o correto posicionamento do transdutor na região central do olho do paciente, alinhado com a mirada centralizada. No entanto, essa maneira de realizar o exame encontra diversas limitações, como a manipulação do anestésico ocular tópico até a disponibilidade deste no momento do exame.[1]

Nesta revisão de tema, analisamos a literatura dos últimos 4 anos acerca da mensuração da bainha do nervo óptico e suas repercussões.

TÉCNICA

A realização do ultrassom do nervo óptico é uma técnica não invasiva, que não expõe o paciente a uma radiação tomográfica, além de ser mais barata e segura, podendo ser realizada à beira do leito, sem necessidade de transferência para outro setor de imagem.[1,5]

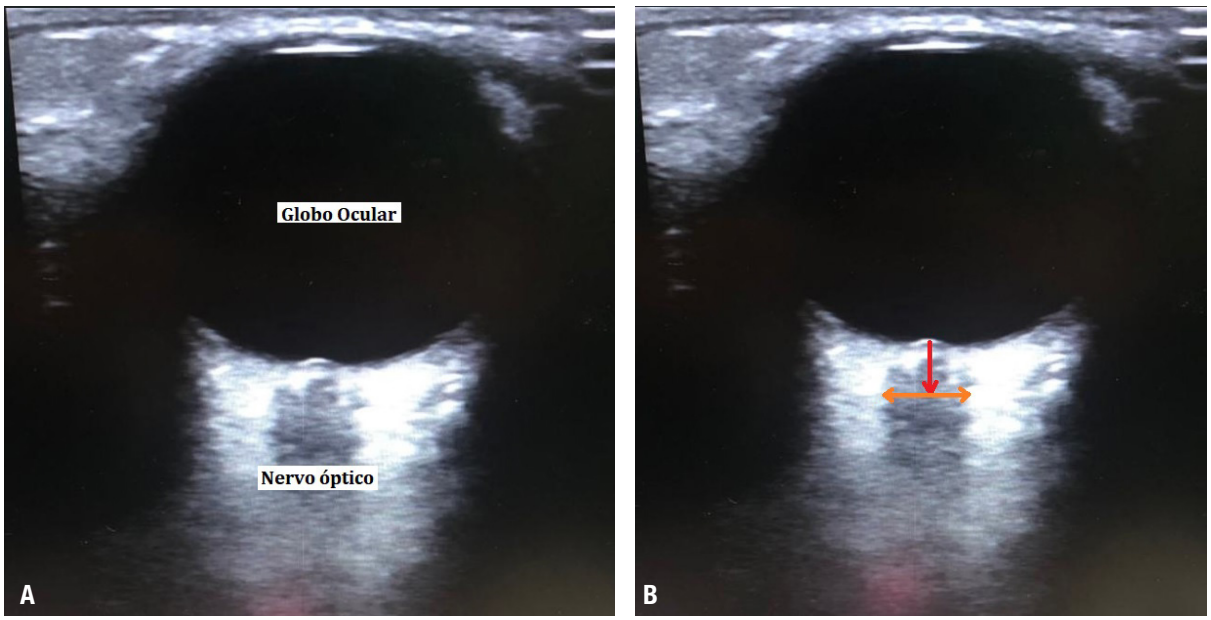
O padrão-ouro para realizar o exame é por meio de um transdutor linear de alta frequência, a fim de garantir imagens de melhor resolução. É sugerido um máximo de 10MHz para evitar danos aos olhos do paciente. Além disso, para segurança do paciente e para evitar lesões termo mecânicas, devemos ajustar o índice mecânico para valores ≤0,23 e o índice térmico ≤1ºC. Ambos os ajustes estão disponíveis nas configurações da maioria dos aparelhos não portáteis. Na prática, a seleção do *preset* ocular no aparelho realiza esses ajustes. A profundidade da imagem sugerida é de 40 a 45mm, que é distância suficiente para visualizar o globo ocular e as estruturas próximas ao nervo óptico. A posição ideal para realização do exame é a supina, e o examinador pode se posicionar na lateral do leito. O gel utilizado pode causar irritações oculares, sendo indicada,

caso haja disponível, a aplicação de um filme adesivo ou Tegaderm® para cobrir o olho fechado, para que não haja contato do gel com o globo ocular. Deve-se tomar cuidado para não permitir bolhas na aplicação do filme adesivo, pois elas impedem a ultrassonografia. O filme adesivo protege o olho do paciente da irritação pelo gel e causa mínima degradação da imagem. A aquisição de imagens deve ser feita tanto por um corte transversal como por um corte longitudinal, pois o nervo óptico tem formato cilíndrico, e a dilatação de seu diâmetro pode ser excêntrica.[3,6,8]

A estrutura da imagem é composta de um globo ocular anecoico de formato circular seguido de um cilindro hipoecoico posteriormente a ele, chamado de nervo óptico (**Figura 1A**). Em suas laterais, bilateralmente, estão situadas as camadas pia-máter, espaço subaracnóideo, camada aracnoide e dura-máter. A imagem obtida deve ser capaz de encontrar a entrada do nervo óptico no globo ocular, posicionada de preferência no centro da tela do ultrassom. A partir dela, a mensuração da bainha é feita em dois momentos: inicialmente, é realizada uma medida partindo da base do globo ocular até a distância de 3mm posteriormente, entrando na região do nervo óptico (cilindro hipoecoico), designado como o local de máxima expansão proximal em casos de HIC; a segunda medida é um corte perpendicular a partir do primeiro ponto, em que será delimitado o diâmetro da bainha, utilizando o cursor de medidas nas bordas externas das linhas hiperecoicas, que se localizam no interior do nervo óptico[2,6,7] (**Figura 1B**).

Encontramos na literatura diferentes definições do ponto de partida ideal para mensuração da bainha, sendo estas: a linha imaginária da retina (que não é normalmente visualizada na imagem); a lâmina cribosa; e o topo do cilindro hipoecoico, representado pelo nervo óptico. A lâmina cribosa inclusive pode gerar artefatos de imagem no interior do nervo óptico, que podem levar a falsas medidas do diâmetro da bainha.[2,3,5]

Uma das maneiras para tornar mais fidedigna a medida do diâmetro da bainha é utilizar a artéria central da retina (ACR) e a veia central da retina como bases para guiar o marcador no momento de fazer as medidas. Antes de realizar a mensuração, é indicado iniciar o exame com o modo Doppler colorido, para identificar o trajeto dos vasos e se estão centralizados com o nervo óptico. A partir de então, deve-se utilizar o fluxo arterial como guia para fazer a medida de 3mm posteriores ao globo ocular.[3,8] O cálculo do diâmetro pode ser feito usando três ou mais mensurações da bainha nas visualizações transversal e longitudinal e, a partir delas, calcular uma média de valores, a fim de definir uma medida mais fidedigna e reduzir o viés do examinador dependente.[3]



Fonte: elaborada pela autora.

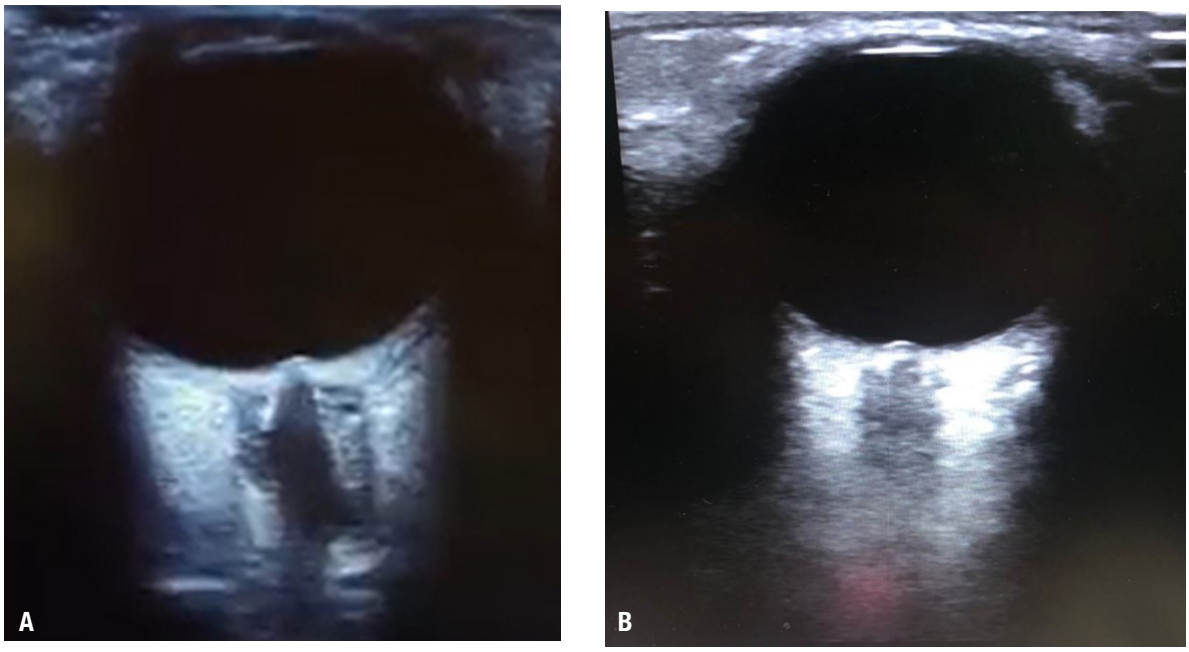
Figura 1. (**A**) Imagem representando as principais estruturas que devem ser insonadas para iniciar as medidas da bainha do nervo óptico: o globo ocular, cilindro anecoico (preto) seguido de uma faixa hipoecoica (cinza), onde fica localizado o nervo óptico, (**B**) Orientação de como realizar as medidas para identificação da bainha do nervo óptico: uma medida vertical de 3mm partindo da base do globo ocular, seguida de uma medida transversal de uma ponta a outra, representando a bainha do nervo óptico.

Anualmente, surgem diversas recomendações de como fazer a medida correta e mais precisa, mas ainda não há um consenso sobre como fazer e quais os valores mais fidedignos. Um protocolo chamado CLOSED utiliza a seguinte técnica: *color Doppler* (relativo ao uso da função Doppler colorido do aparelho para identificar os vasos retinianos centrais e, a partir deles, guiar o local de mensuração da linha de 3mm posterior à base do globo ocular, diminuindo os erros na direção do cursor, que podem ocorrer por tortuosidade do nervo); *low power examination* (exame de baixa potência para evitar lesões retinianas, com ajustes de índices adequados para o procedimento); *optic disk clarity* (referente à visualização correta do disco óptico, a fim de que haja um marco seguro para a saída dos 3mm posteriores ao globo ocular); *safety – short examination duration* (pois o exame pode ser feito à beira do leito e de forma segura para o paciente); *elevated frequency* (o transdutor utilizado deve ser o linear, de alta frequência, que gera imagens de melhor resolução); *dual measurements* (duplas mensurações, tanto na visualização transversal quanto longitudinal).[8]

A partir da imagem obtida do nervo óptico – leia-se o cilindro hipoecoico –, existem dois grupos de achados: imagens com linhas hiperecoicas no interior da imagem hipoecoica do nervo ou imagens sem a visualização dessas linhas, somente com a estrutura central hipoecoica, chamadas de categoria A e B, respectivamente[2] (**Figura 2**).

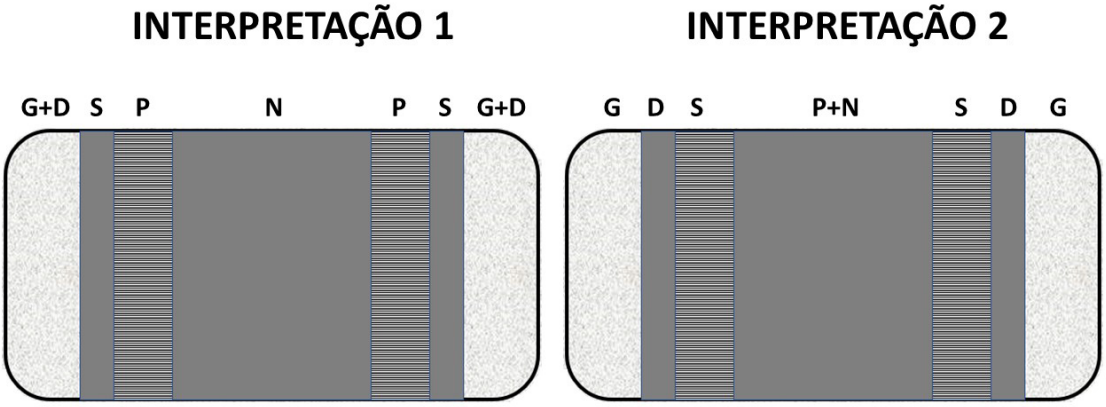
Muitas medidas trazem erros de interpretação e, consequentemente, erros diagnósticos, ao mensurar de maneira incorreta as estruturas encontradas na imagem. O nervo óptico já é bem definido como a estrutura hipoecoica central, cilíndrica. As demais estruturas laterais, definidas como pia-máter, espaço subaracnóideo e dura-máter, possuem definições mais heterogêneas.[2] Existem duas maneiras de fazer essa mensuração, de acordo com diferentes autores (**Figura 3**). Uma interpretação considera que a pia-máter e a dura-máter não refletem ondas sonoras, sendo a pia-máter uma fusão com o nervo óptico escuro no centro, enquanto o espaço subaracnóideo e a gordura retrobulbar se apresentam como estruturas hiperecogênicas, mais claras. Nesse caso, a dura-máter seria uma faixa escura entre as duas imagens hiperecoicas (o espaço subaracnóideo e a gordura retrobulbar). A outra maneira de interpretar considera que o espaço subaracnóideo não levaria à formação de imagem hiperecoica, e as camadas pia-máter, dura-máter e gordura retrobulbar se apresentariam todas como faixas hiperecogenicas. Nesse caso, a camada pia-máter seria a banda hiperecoica bilateralmente presente na região escura, enquanto o espaço subaracnóideo se apresentaria como espaço hipoecoico entre a pia-máter e a gordura retrobulbar.[2]

Enquanto persistem algumas dúvidas, cada serviço deve adotar um protocolo para medida do diâmetro da bainha do nervo óptico, de forma que todas as medidas do serviço sejam comparáveis na evolução de um mesmo paciente e entre diferentes pacientes.



Fonte: elaborada pela autora.

Figura 2. (**A**) Categoria A, com linhas hiperecoicas no interior do cilindro hipoecoico. (**B**) Categoria B, com um unico cilindro hipoecoico sem linhas hiperecoicas em seu interior.



Fonte: Stevens et al.[2]
G: gordura retrobulbar; D: dura-máter; S: espaço subaracnóideo; P: pia-máter; N: nervo óptico.

Figura 3. Duas diferentes interpretações encontradas na literatura sobre as imagens ultrassonográficas, com as seguintes estruturas: gordura retrobulbar; dura-máter; espaço subaracnóideo; pia-máter e nervo óptico.

LIMIAR DE MEDIDAS E CORRELAÇÕES CLÍNICAS

O valor normal do diâmetro da bainha do nervo óptico ainda não pode ser definido precisamente. O valor máximo da normalidade é uma faixa, ainda não existindo um único valor específico e bem definido. Essa faixa se encontra entre os valores 5 e 6mm, na prática clínica, podendo se estender até 6,2 como ponto de corte.[5] Encontramos, quando comparadas as medidas invasivas e não invasivas, uma faixa mais curta de variação da bainha, com ponto de corte de 5,5 e 6,1mm, respectivamente – sendo este último um dado mais confiável como valor limítrofe para HIC.[7]

Os diversos estudos foram realizados em múltiplas patologias, como trauma craniencefálico, hemorragia subaracnóidea (HSA) e hemorragia intracraniana. Comparando as técnicas longitudinal e transversal de avaliação do nervo óptico, observa-se que, em indivíduos saudáveis, a mensuração longitudinal mostra menos variabilidade entre os olhos quando comparada com a medida transversal, possivelmente devido à presença de menos artefatos, mas que, nos pacientes com HIC, a medida transversal mostrou melhor acurácia nos valores do diâmetro da bainha. Nesse estudo, o provável fator confundidor é o tempo médio de 82 minutos entre a mensuração da PIC pelos dois métodos (ultrassonográfico não invasivo e invasivo por meio do cateter intracraniano), podendo ter contribuído para os resultados conflitantes. Além disso, mesmo após a normalização da PIC, existe a teoria de que a bainha perdure dilatada, fato que deve ser levado em consideração na interpretação da evolução da HIC.[5]

A variação de valores do diâmetro da bainha acontece não só com a população heterogênea, mas também com a idade. Em crianças, esse valor pode variar de acordo com a patência da fontanela anterior e pela patologia que está acometendo o paciente. Nas crianças menores de 1 ano, os valores de nervo óptico não são confiáveis, pois a bainha do nervo cresce até essa idade.[3] Os valores limites considerados normais encontrados por alguns autores foram 5,0mm em adultos, 4,5mm em crianças de 1 a 15 anos e 4,0mm em menores de 1 ano de idade. A medida da bainha em pacientes pediátricos se torna mais fiel em pacientes com HIC a partir dos 10 anos de idade, devido aos fatores de crescimento da bainha ao longo dos anos.[9] Já outro autor cita que, em pacientes idosos>65 anos, a medida da bainha apresentava valor de normalidade maior quando comparado com pacientes mais jovens.[10]

A definição da HIC não é homogênea na literatura. Definições da HIC usando a PIC variam de limiar mínimo entre 20 e 30cmH_2O. Como algumas referências usam mmHg para relatar os valores, lembrar que cada 1mmHg corresponde a 1,36cmH_2O.[4] Sabendo-se que essa variação da definição de HIC existe, os diâmetros de bainha de nervo óptico que se correlacionam à HIC também variam.

Alguns estudos citam o ponto de corte para HIC a depender da gravidade da patologia, como, por exemplo, 6,1mm para lesões cerebrais graves, 4,2mm para lesões moderadas e 3,6mm em um grupo controle. Outro estudo correlaciona os valores ultrassonográficos do diâmetro da bainha com a medida de PIC medida por cateter invasivo, sendo os valores <4,4mm

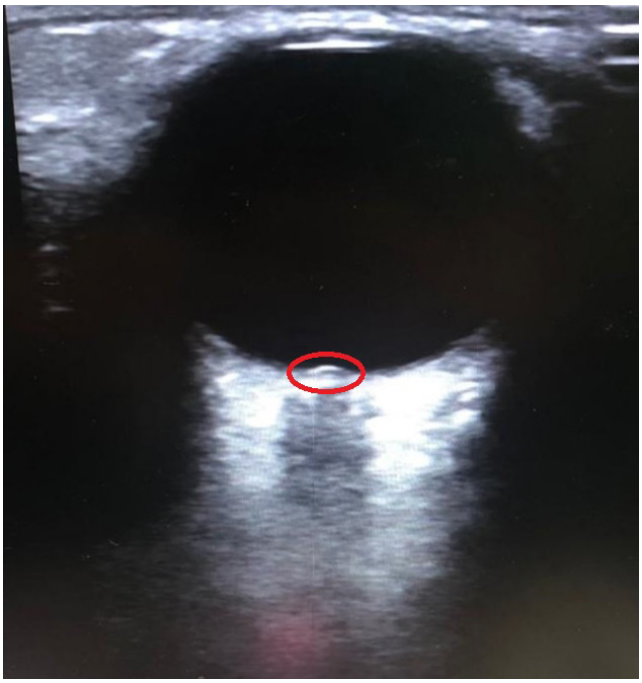
para PIC <20cmH_2O e >5,4mm em pacientes com PIC>20cmH_2O.[11]

Existe também, na literatura, a descrição de um valor de corte da bainha do nervo óptico que pode ajudar a diferenciar os acidentes vasculares cerebrais (AVC), com os valores de 5,5mm±0,4 e 6,1mm±0,7 para isquêmicos e hemorrágicos, respectivamente, justificado pelo fato de o AVC isquêmico apresentar HIC mais tardia. Outra associação descrita é com o infarto maligno de artéria cerebral média (ACM), em que o ponto de corte descrito como normal foi até de 5,6mm, no respectivo estudo, podendo ser usado como auxiliar na tomada de decisão.[10] Além disso, o retorno da bainha para valores normais é tardio e variável após o paciente ter sido portador da condição de aumento pressórico intracraniano. Essa variação nos valores acontece devido à heterogeneidade da experiência do operador no ultrassom à beira do leito, além de amostras variáveis nos estudos e de os métodos de estudo duplo-cego não serem bem desenhados.[5]

Um estudo feito com pacientes com HSA comparou os valores da bainha obtidos pelo ultrassom e pela ressonância, mostrando resultados com relativa semelhança entre eles. No entanto, não conseguiu comprovar a relação direta do diâmetro da bainha do nervo óptico com HIC, quando comparadas com as medidas obtidas pelos cateteres intraventriculares em pacientes com HSA.[6,12]

Em suma, apesar de não haver um valor crítico definido conhecendo-se a faixa de valores associados a patologias na literatura, podemos dizer que, em adultos, valores <4,5 ou 5,0mm provavelmente estão normais, enquanto >6,0 ou 6,5mm claramente são patológicos, ficando a faixa intermediária como uma zona cinzenta indeterminada na qual se deve basear mais na clínica do paciente

Uma das estruturas que pode auxiliar no diagnóstico é a identificação da elevação do disco óptico para detectar HIC (**Figura 4**). Neste estudo, se essa elevação for >0,4mm, ela tem alta especificidade e boa sensibilidade para predizer HIC com PIC >22mmHg, mas ainda são necessárias mais publicações sobre o tema. Um dos fatores limitantes dessa visualização são as drusas benignas, estruturas hiperecoicas que correspondem ao depósito de material proteico, as quais podem confundir o examinador na hora de determinar a elevação do disco óptico.[3,5] O maior limitante ao uso do papiledema nas patologias agudas no pronto-socorro é que sua instalação pode ser um achado muito tardio de horas a dias em adultos podendo chegar a semanas em crianças, além da possibilidade de confusão diagnóstica com pseudopapiledema.[9]



Fonte: elaborada pela autora.

Figura 4. Na base do globo ocular (círculo), o representativo do disco óptico discretamente elevado. Sua correlação com papiledema depende de quantos milímetros de elevação ele possui em relação à retina.

Finalmente, o diâmetro da bainha do nervo óptico não se mostrou útil para monitorização das medidas de controle da HIC. Estudo sobre a mensuração de HIC por meio da avaliação ultrassonográfica da bainha do nervo óptico em pacientes submetidos à hemicraniectomia não mostrou bom resultado, possivelmente pela lesão cerebral primária e a própria craniectomia, não sendo uma medida confiável para estimar a presença de HIC nesses pacientes. Mostrou, porém, possuir valor prognóstico para pacientes com resultados desfavoráveis após o procedimento de hemicraniectomia.[13]

Não há evidência que demonstrem benefício em empregar um manejo para HIC a partir dos achados ultrassonográficos. No entanto, a história e o quadro clínico sugestivos de HIC justificam a implementação de medidas para a HIC, e a corroboração pelo método ultrassonográfico aumenta a confiança dessa conduta.

CONCLUSÃO

O uso do ultrassom *point-of-care* tem se estabelecido em múltiplas situações em emergência, incluindo a avaliação de pressão intracraniana por meio do ultrassom de nervo óptico e a mensuração do diâmetro da bainha do nervo. Porém, apesar de surgirem frequentemente novos estudos na área, ainda não há um ponto de corte bem estabelecido acerca de qual medida confere uma confirmação diagnóstica. O que se pode fazer

na atualidade é utilizar a ferramenta como método de triagem para hipertensão intracraniana, o que deve ser feito por profissionais experientes e, de preferência, com três ou mais medidas em duas incidências, para melhor acurácia do método, a fim de garantir mais fidedignidade às terapias empíricas realizadas a partir das medidas obtidas com o ultrassom.

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Review

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JORNAL BRASILEIRO de MEDICINA DE EMERGÊNCIA

Development of an airway bundle in the Emergency Department: improving the odds against the airways

Desenvolvimento de um bundle de via aérea no departamento de emergência

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ABSTRACT

Proficiency in airway management is a fundamental competence of every emergency physician. However, the scenario and patient conditions are often not ideal, increasing the procedural risk. The development of an airway bundle, including an airway trolley with separate drawers, an airway approach plans organized by colors and steps, a checklist and cognitive aids, aims to reduce the morbidity and mortality of the procedure in a scenario where anatomical, physiological and psychological factors tend to cause more difficulties than any other place in the hospital.

Keywords: Airway management; Patient safety; Emergency; Patient care bundles; Checklist; Decision making

RESUMO

A proficiência no manejo da via aérea é uma competência fundamental para todo emergencista. No entanto, o cenário e as condições dos pacientes não são ideais na maioria das vezes, o que eleva o risco do procedimento. Dessa forma, o desenvolvimento de um pacote de via aérea, incluindo um carro específico com gavetas separadas, planos de abordagem à via aérea organizados por cores e etapas, *checklist* e ajudas cognitivas, visa diminuir a morbimortalidade do procedimento em um cenário em que os fatores anatômicos, fisiológicos e psicológicos tendem a causar mais dificuldades do que em qualquer outro local do hospital.

Descritores: Manuseio das vias aéreas; Segurança do paciente; Emergências; Pacotes de assistência ao paciente; Lista de checagem; Tomada de decisões

INTRODUCTION

Airway management is a routine procedure in the Emergency Department (ED). In this setting, there is usually not enough time to fully prepare patients as they do not undergo extensive pre-procedure assessment, do not have an adequate fasting period, and often present with hemodynamic/respiratory instability or imminent airway compromise. These patient-level characteristics along with environmental factors such as an overcrowded and understaffed ED may increase the complexity of the procedure, with increased risk of catastrophic consequences for patients, providers, and the healthcare system.

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The Fourth National Audit Project of the Royal College of Anaesthetists and Difficult Airway Society (NAP4) was responsible for bringing to light a detailed analysis of airway-related complications.[1-3] It showed that clinical outcomes could have been different if a structured approach to airway management had been undertaken.[4] When a difficult airway arises, it is crucial to act in a rapid and systematized manner. Essential equipment, for example, must be logically organized in a nearby location. Nevertheless, evidence from the NAP4 analysis showed that getting basic equipment such as endotracheal tubes, guidewires, nasopharyngeal cannulas, or supraglottic devices can be much slower than anticipated. In these situations, the risk of cognitive overload and deteriorating decision-making ability can negatively affect patient outcomes.[5]

With the goal of minimizing complications related to airway management in the ED, we developed an "airway bundle" that includes a pre and post intubation checklist, a medication box with labels, structured plans and a trolley with color coded drawers.

The main objective of our experience report is to share how we develop an airway bundle. This bundle was created in the ED of the *Hospital de Clínicas de Porto Alegre* (HCPA), a large tertiary hospital with more than 800 beds and an average 30.000 number of ED visits per year.

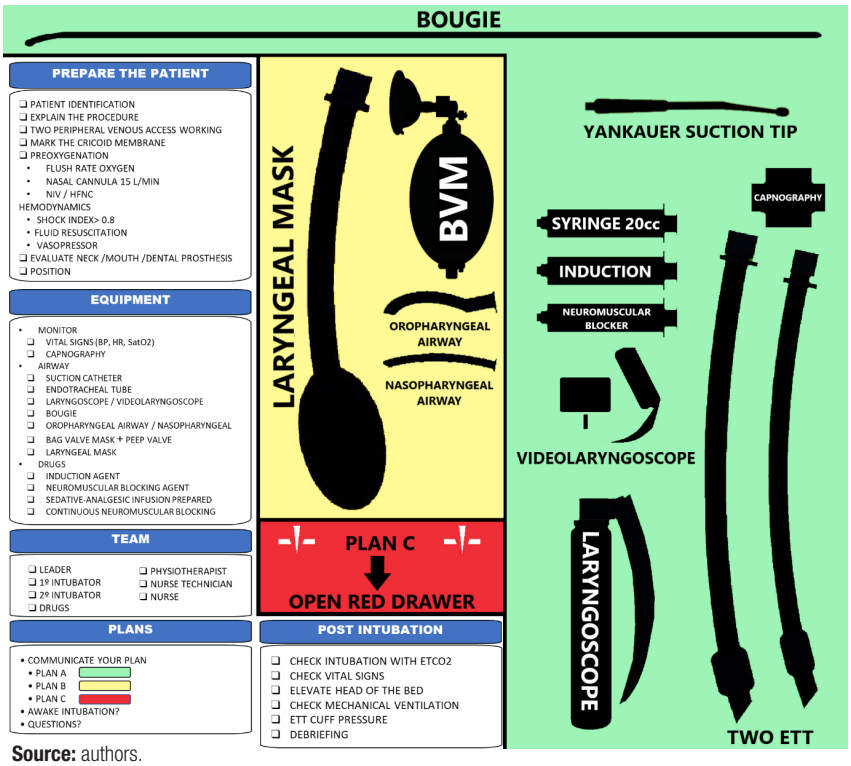
METHODS

The airway bundle was developed to fit the local conditions of our ED after reviewing evidence-based guidelines[5-8] and prior experiences on developing airway trolleys.[9,10] We used an iterative process in which the elements of the bundle were first presented to stakeholders involved in airway management in the ED including registered nurses, nurse assistants, respiratory therapists, residents and attendings. Based on the team's feedback, adjustments were made before its final assembly.

RESULTS

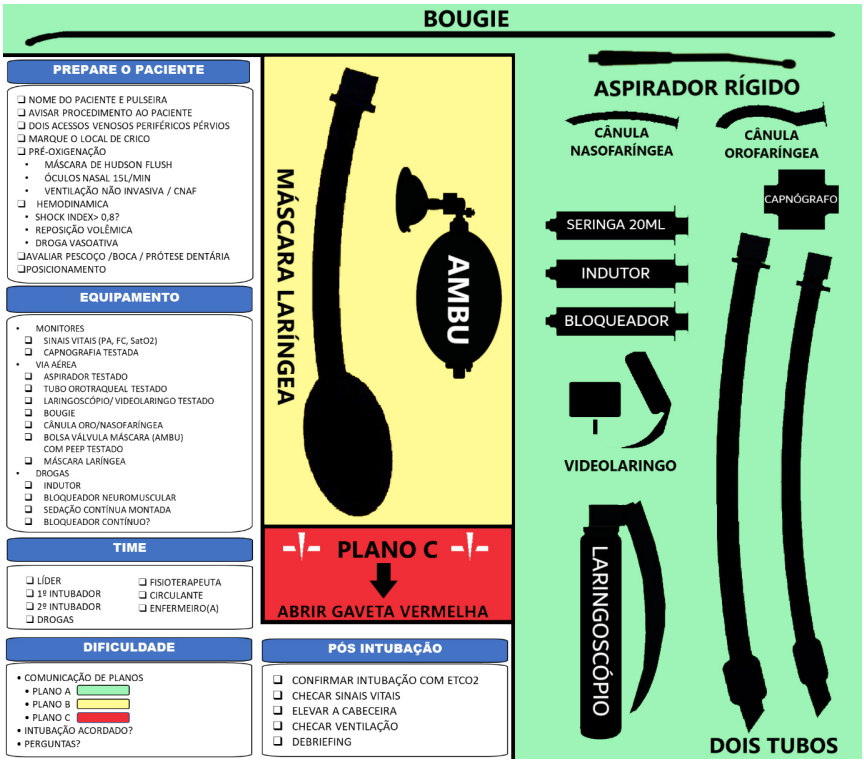
Airway checklist

An airway checklist was created based on prior published examples.[6,11-13] Prior to its final version, we iteratively tested draft versions in real cases and actively asked for feedback from key stakeholders. The final English and Portuguese version are available in the **Figures 1 and 2**, respectively. In order to integrate this element into the bundle, we printed the checklist along with a graphic representation of the procedural materials (i.e., pictogram) and we adhered it to the lid of the trolley (**Figure 3**).



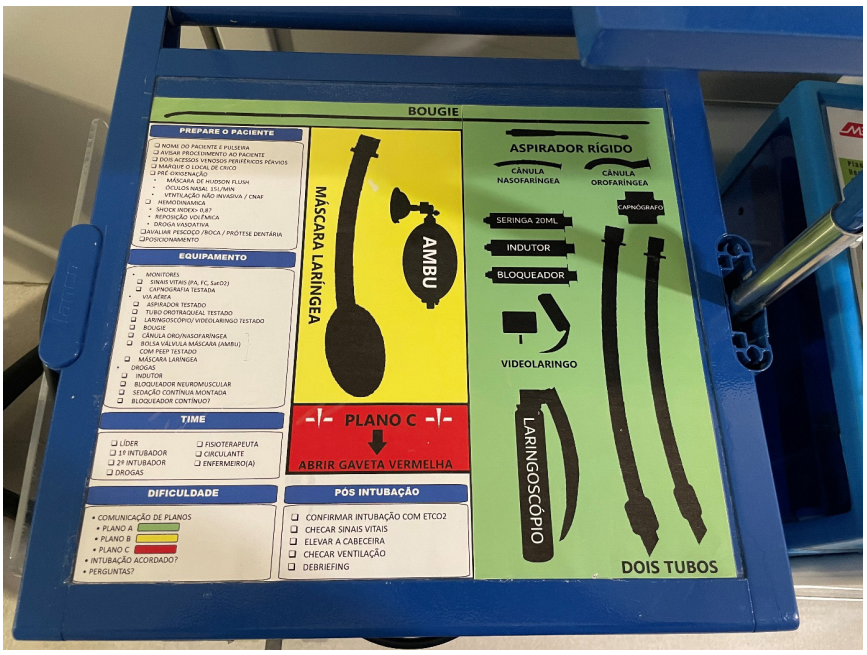
Source: authors.

Figure 1. Checklist in English.



Source: authors.

Figure 2. Checklist in Portuguese.



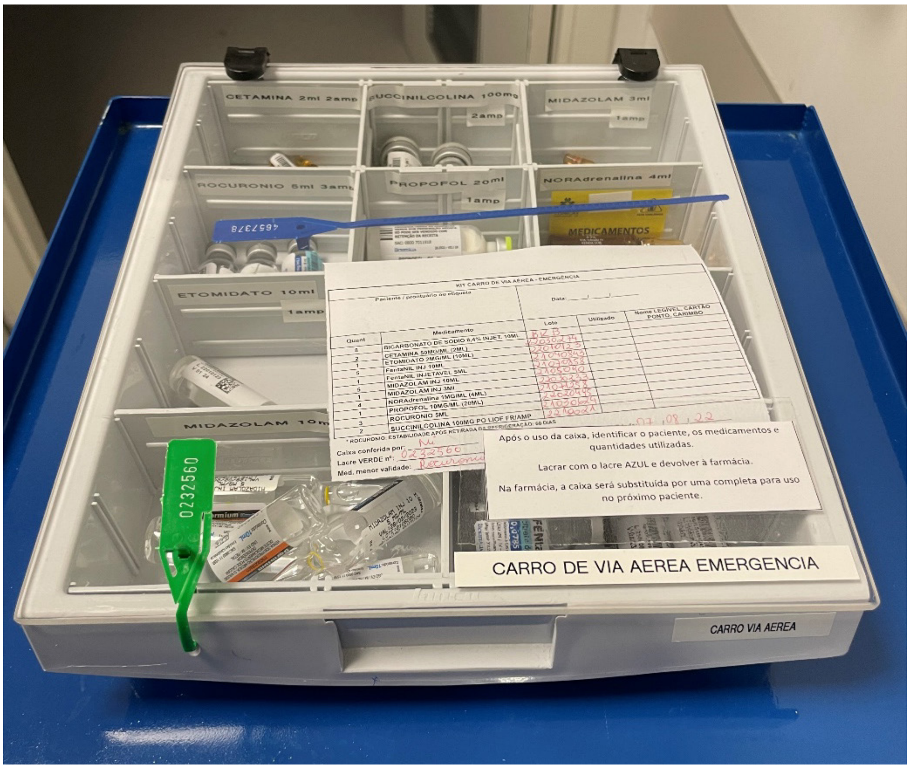
Source: authors.

Figure 3. Airway lid with pictogram.

The checklist was divided into five main elements: patient preparation; equipment, monitors, and medications; role assignment by the leader followed by team members saying their names and roles prior to intubation; physician responsible for the airway explains what is the plan, and ask for questions and suggestions; post intubation: vital signs check, head of the bed adjustment, ventilator settings and, most importantly, debriefing.

Airway medication box

An airway medication box was created in order to expedite the process of acquiring the medications needed for the procedure. It stays on top of the trolley **(Figure 4)**. After discussing the procedural workflow with nursing technicians and pharmacists, we identified that team members often had to moved away from the bedside to get medications during critical periods of the procedure. Also, labeling **(Figure 5)** of each syringe with the different medications was difficult due to time constraints. For this reason, we created labels with drug names and their concentrations. The following drugs were included in this box: etomidate, ketamine, succinylcholine, rocuronium, midazolam, fentanyl, propofol, noradrenaline, and bicarbonate.



Source: authors.

Figure 4. Medication box.

PROPOFOL (10mg/ml)	FENTANIL (50mcg/ml)	ETOMIDATO (2mg/ml)	MIDAZOLAM (5mg/ml)	CETAMINA (50mg/ml)
PROPOFOL (10mg/ml)	FENTANIL (50mcg/ml)	ETOMIDATO (2mg/ml)	MIDAZOLAM (5mg/ml)	CETAMINA (50mg/ml)
PROPOFOL (10mg/ml)	FENTANIL (50mcg/ml)	ETOMIDATO (2mg/ml)	MIDAZOLAM (5mg/ml)	CETAMINA (50mg/ml)
PROPOFOL (10mg/ml)	FENTANIL (50mcg/ml)	ETOMIDATO (2mg/ml)	MIDAZOLAM (5mg/ml)	CETAMINA (50mg/ml)
PROPOFOL (10mg/ml)	FENTANIL (50mcg/ml)	ETOMIDATO (2mg/ml)	MIDAZOLAM (5mg/ml)	CETAMINA (50mg/ml)
PROPOFOL (10mg/ml)	FENTANIL (50mcg/ml)	ETOMIDATO (2mg/ml)	MIDAZOLAM (5mg/ml)	CETAMINA (50mg/ml)
PROPOFOL (10mg/ml)	FENTANIL (50mcg/ml)	ETOMIDATO (2mg/ml)	MIDAZOLAM (5mg/ml)	CETAMINA (50mg/ml)
PROPOFOL (10mg/ml)	FENTANIL (50mcg/ml)	ETOMIDATO (2mg/ml)	MIDAZOLAM (5mg/ml)	CETAMINA (50mg/ml)
SUCCINILCOLINA (10mg/ml)	ROCURÔNIO (10mg/ml)	BICARBONATO 8,4% (84mg/ml)	NORADRENALINA ____mg/ml	ÁGUA DESTILADA
SUCCINILCOLINA (10mg/ml)	ROCURÔNIO (10mg/ml)	BICARBONATO 8,4% (84mg/ml)	NORADRENALINA ____mg/ml	ÁGUA DESTILADA
SUCCINILCOLINA (10mg/ml)	ROCURÔNIO (10mg/ml)	BICARBONATO 8,4% (84mg/ml)	NORADRENALINA ____mg/ml	ÁGUA DESTILADA
SUCCINILCOLINA (10mg/ml)	ROCURÔNIO (10mg/ml)	BICARBONATO 8,4% (84mg/ml)	NORADRENALINA ____mg/ml	ÁGUA DESTILADA
SUCCINILCOLINA (10mg/ml)	ROCURÔNIO (10mg/ml)	BICARBONATO 8,4% (84mg/ml)	NORADRENALINA ____mg/ml	ÁGUA DESTILADA
SUCCINILCOLINA (10mg/ml)	ROCURÔNIO (10mg/ml)	BICARBONATO 8,4% (84mg/ml)	NORADRENALINA ____mg/ml	ÁGUA DESTILADA
SUCCINILCOLINA (10mg/ml)	ROCURÔNIO (10mg/ml)	BICARBONATO 8,4% (84mg/ml)	NORADRENALINA ____mg/ml	ÁGUA DESTILADA

Source: authors.

Figure 5. Medication labels.

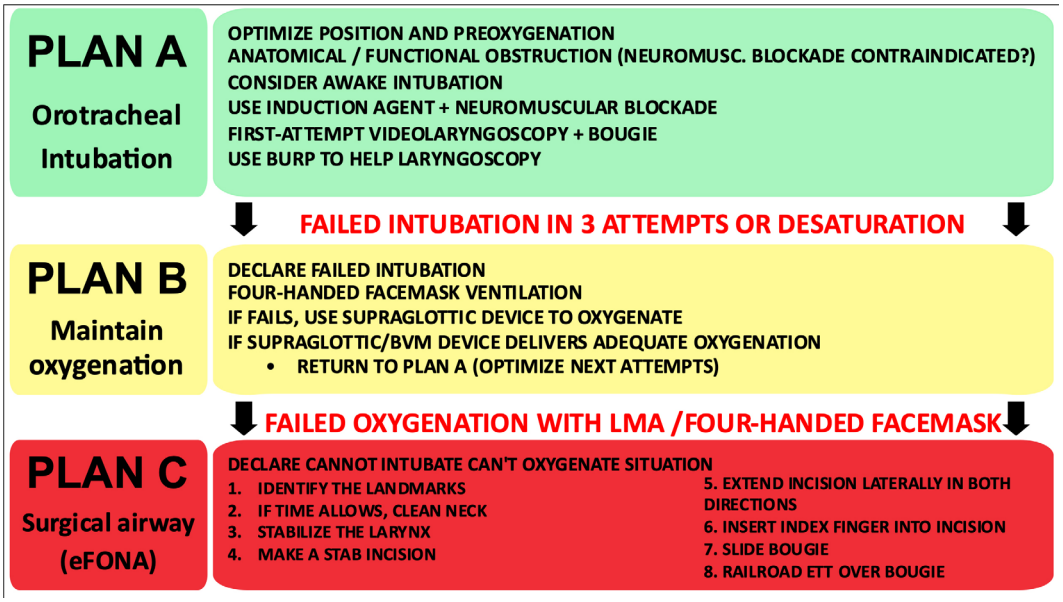
Airway management plans

The definition of plans and the organization of these in sequential form (A, B and C; **Figures 6 and 7**) allows the reproducibility and systematization of these approaches in a simple and logical way. Its use has been associated with better peri-procedural outcomes and less cognitive burden by physicians.[7]

Airway plans are often divided into four: A, B, C, and D. However, we combined C and B because recent evidence shows that joining these plans better reflects an oxygenation rescue phase, interleaving the supra-glottic device, bag-valve-mask and positive end-expiratory pressure (PEEP) valve ventilation.[7] Another reason was that the addition of phases may complicate the decision-making process of performing cricothyroidotomy, a procedure avoided at all costs by many physicians.

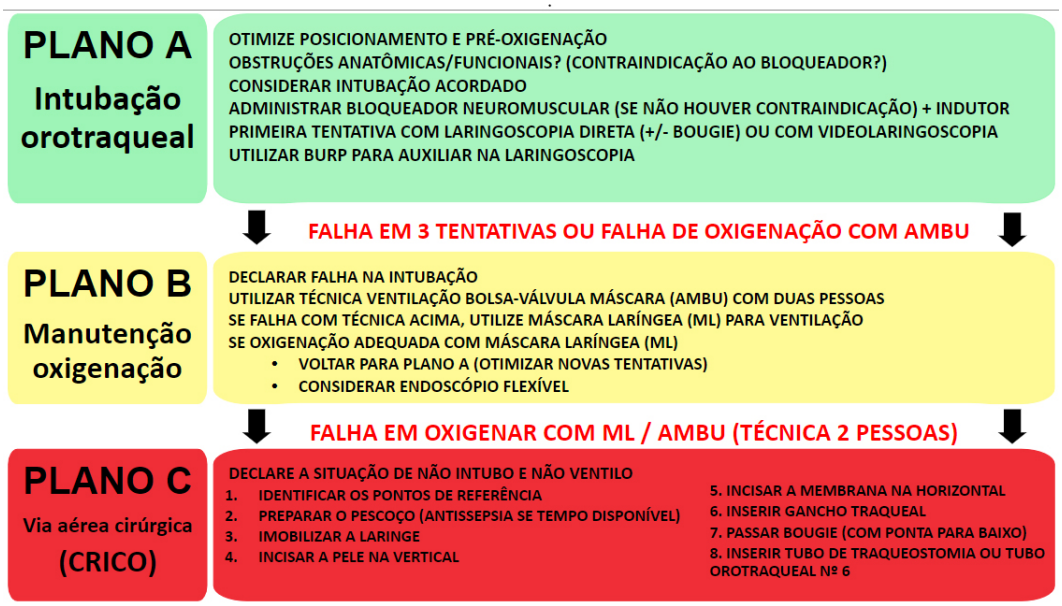
The Difficult Airway Society (DAS) algorithm,[6] the Vortex approach,[14] Sherren et al.[11] and the Bern Hospital protocol in Switzerland[9] were adapted to define the plans that were used in our airway bundle.

Plan A is focused in intubating the patient during the first laryngoscopy. If this fails, the airway physician has two more attempts. If desaturating at any moment during the attempts, it triggers the next plan.



Source: authors.

Figure 6. Airway plans English.



Source: authors.

Figure 7. Airway plans Portuguese.

This "change" should be perceived by the intubator, and if they insist on plan A, someone else (ideally the team "leader" who is not intubating) should guide the change to plan B or C.

Plan A is aimed to achieve the highest first pass success rate possible. Patient position is optimized. Videolaryngoscopy (VL) and bougie are preferred for the first attempt. If glottis visualization is not optimal, displacement of the larynx in the backward and upward directions with rightward pressure on the thyroid cartilage (i.e., backward, upward, rightward pressure [BURP] maneuver) is tried. Another technique that must be used is head elevation by right hand of the physician holding the laryngoscope. Awake intubation using lidocaine spray and gel is another option that should be elicit by the team whenever feasible.

Plan B is aimed to rescue oxygenation. If desaturation occurs during the procedure, risk of post-intubation cardiac arrest increases;[15] therefore, the mindset of the team should shift to a more difficult airway, so that situational awareness increases. If hypoxemia occurs, bag valve mask (BVM) attached to a PEEP valve with the 4- hand technique should be the first choice. In the case it does not change oxygenation, laryngeal mask is the second option. If it improves oxygen saturation, another intubator or a different technique is used (e.g., hyper-angulated blade VL, or fiberoptic intubation) or a different patient position. If it does not enhance oxygenation, airway leader should declare "can't intubate, can't oxygenate" (CICO) situation.

Plan C is cricothyrotomy, and the preferred technique is scalpel-finger-bougie. While preparing for cricothyroidotomy, rescue oxygenation can be attempted with BVM and two people (4-hand technique for mask sealing). As this procedure rarely occurs and it is associated with a highly stressful situation,[16] it is paramount that team members train it through regular simulations.

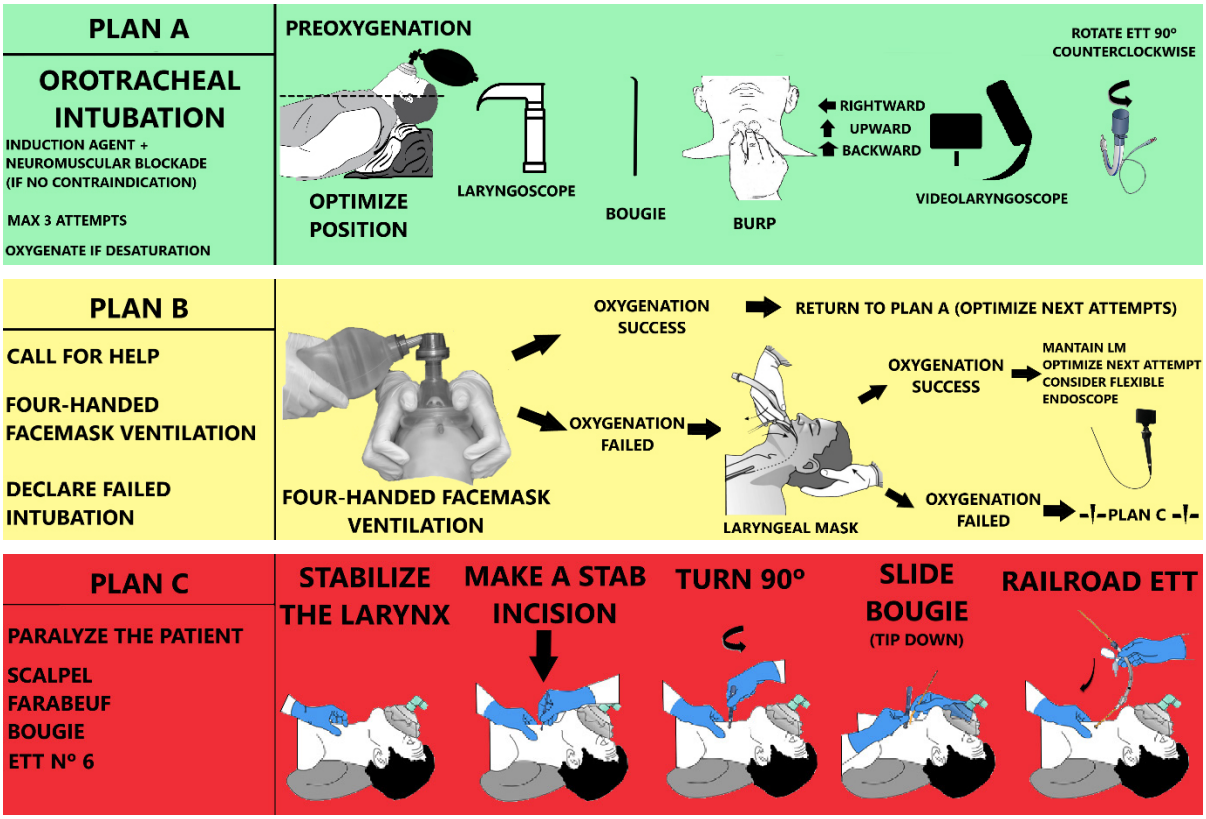
The trolley and its color-coded drawers

The arrangement of the materials occurs according to the management plans (A, B and C). The goal is simplicity, logic, organization, and standardization. To facilitate the intubation process, some cognitive aids were added.

All drawers are individually sealed in order to facilitate the checking process by the nursing staff and are easily identified by the plans with two types of cognitive aids, colors and images of the procedure that will be performed on each plan. The colors follow the traffic light/signal order. Plan A is green, B is yellow and C is red (**Figures 8 to 11**).

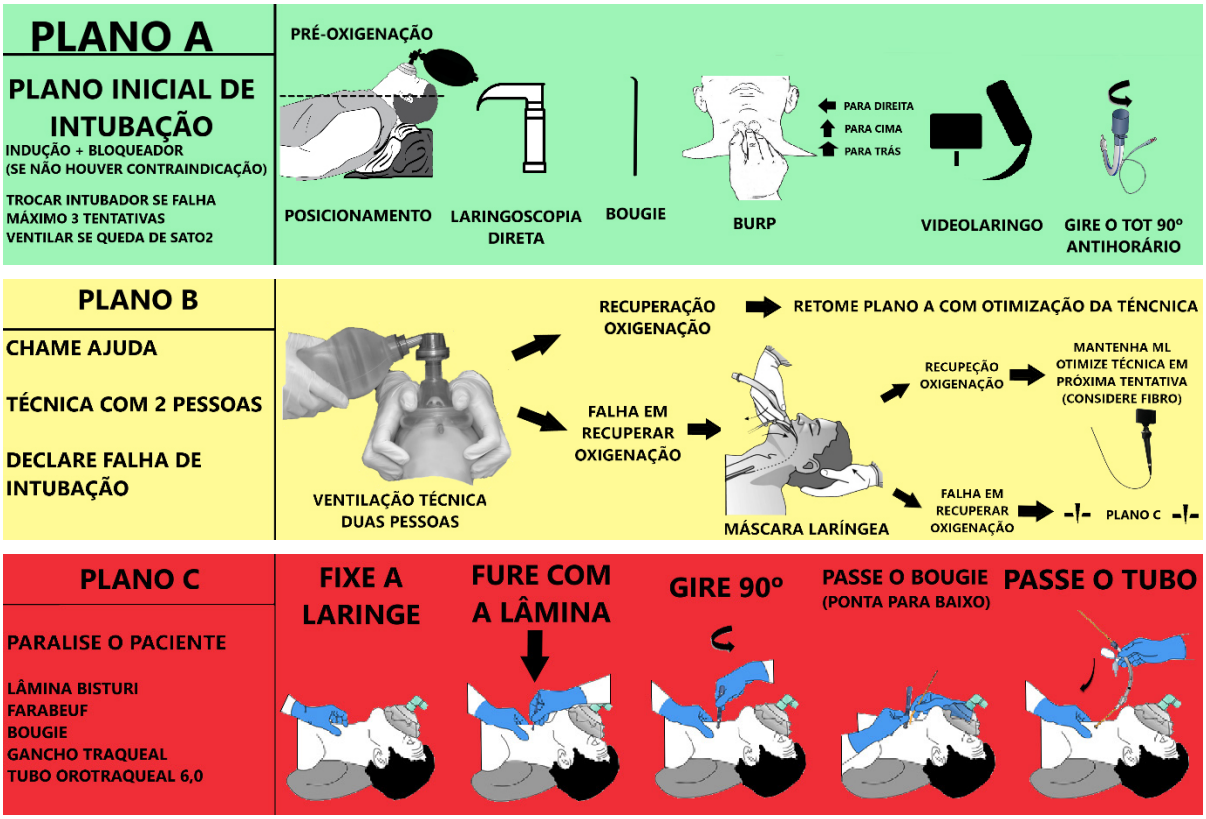
Source: authors.
Figure 8. Airway trolley.

Source: authors.
Figure 9. Airway trolley.



Source: authors.

Figure 10. Color coded drawers English.



Source: authors.

Figure 11. Color coded drawers Portuguese.

The location of the airway trolley is easily approached, broadly marked and widely known by ED stakeholders. Ideally, it should be located in the area where airway management is most frequently performed. In our service, the resuscitation bay is where most intubations are performed. However, situations that require stabilization of a definitive airway may also occur in other areas of the ED and, occasionally, it is not possible to transfer these patients to the place near the trolley. Therefore, the presence of wheels and easy mobilization of the trolley is of paramount importance. It can then provide immediate availability of all needed equipment, thus not depending on the availability of materials in certain areas of the ED or on the displacement of an employee from the bedside to get them. The equipment available in each drawer is listed in **Table 1**.

DISCUSSION

In this quality improvement project, we developed an airway bundle composed of a trolley with color coded drawers representing structured airway plans (A, B, and C) along with a pre-intubation checklist adhered to its lid, a medication box with labels and extra cognitive aids. The materials described here were selected based in their availability at our hospital.

We discussed here how human factors, cognitive aids, checklists and logically organized and selected materials play a fundamental role in airway management.

Importantly, the development of an airway bundle must be a multidisciplinary and continuous construction, in which all members of the team must be proficient in the organization, flow and knowledge of its elements. For this, simulations between team members must be performed as a routine.

Differently from the operating room setting, the ED, the Intensive Care Unit (ICU) and the ward have environmental differences that increase the complexity and challenges of airway management.[7] Therefore, it is of paramount importance that when performing airway management, cognitive tools are available to assist the professionals participating in the procedure. In addition, the ready availability of all materials, medications, and devices is key for procedural success. Although multiple guidelines exist, whether difficult, pediatric, obstetric, or in the ICU, few studies have addressed the development and/or implementation of airway trolleys. Most guidelines provide generic guidance on assembly, some indicating minimum material, but not enough for easy adaptation.[10]

Table 1. Material available in each drawer of the airway trolley

Plan A – green drawer	Plan B – yellow drawer	Plan C – red drawer
Laryngoscope handle	Oropharyngeal airway n°. 3	Scalpel blade 11
ETT 7	Oropharyngeal airway n°. 4	Shoelace
ETT 7,5	Oropharyngeal airway n°. 5	ETT 6
ETT 8	Nasopharyngeal airway n°. 9	Tracheostomy cannula n°. 7
ETT 8,5	Nasopharyngeal airway n°. 10	Tracheostomy cannula n°. 7,5
Battery	Nasopharyngeal airway n°. 11	Tracheostomy cannula n°. 8
Macintosh blade n°. 4	Capnograph	Tracheostomy cannula n°. 8,5
Macintosh blade n°. 5	Bag valve mask	Bougie
Miller blade n°. 4	Syringe 20mL	Syringe 20mL
Shoelace	Laryngeal mask n°. 3	Sterile glove 7,5
Stylet	Laryngeal mask n°. 4	Sterile glove 8
Bougie	Laryngeal mask n°. 5	Sterilizing solution
Capnograph	Lidocaine gel	Gauze
Syringe 20mL		Cricothyrotomy kit
Surgical pen		
Lidocaine gel		
Lidocaine spray 10%		
Magill forceps		
Yankauer suction		
Videolaryngoscope		

ETT: endotracheal tube.

Human factors and the airway

To summarize airway management in a one-page algorithm is to underestimate how environmental, human, and psychological factors affect the outcome of such a risky procedure. Even highly trained teams fare worse when environmental factors are suboptimal.[17] There is evidence that emergency airway management is directly influenced by human factors including but not limited to leadership, communication, interpersonal relationships and teamwork.[18] Most importantly, the interaction between these components and psychological, cognitive, environmental and cultural aspects play key roles in how smoothly the airway is managed in the ED.[1,2,5,6,19] The discussion of these factors in the current guidelines highlight that airway management should be approached in a multidisciplinary way and based on simulations.[20]

In the coronavirus pandemic, the number of intubations was higher than in any other period in history. In an attempt to meet emergency demands in the midst of a catastrophe, the provision of numerous, previously less common and less used devices such as bougies and laryngeal masks (LMA) did not result in a more effective approach, but rather increased the degree of uncertainty about when, how, and on whom to use such devices.

The airway trolley is not an intubation closet, or a small storeroom with wheels. A well-organized airway trolley should contain an adequate amount of strategically selected and positioned equipment.[21] The goal is to be simple without being simplistic, so that at times of cognitive overload there is no doubt or indecision about which device to use. This also reduces the number of decisions the team must make, decreasing mental effort.

Another key point in standardizing equipment is that fewer new techniques need to be learned, and those available can be mastered by the team. The Australian and New Zealand College of Anaesthetists (ANZCA) advocates that it is potentially dangerous to store excess equipment within the airway trolley.[8]

The use of cognitive aids

Equipment layout is an important piece of airway management. The airway trolley should follow the precepts of clinical integration, that is, its layout should be aligned with the workflow, physical space, and operational procedures of the institution so that the cognitive aids become an extension. All drawers have different icons, letters and colors, facilitating identification.[21]

One cognitive aid used was color coding, which consists in the use of chromaticity to differentiate items in the same panel, ensuring compatibility, standardization, significance, discriminability and detectability, as well as a systematic classification of certain items. This helps in preventing errors and can increase patient safety.[22]

Color coding is useful as long as the expectation of the chosen color is compatible with the reality of the team that will use it. One of the most common stereotypes is that of the traffic light: green, yellow and red, which indicates operating within tolerance, attention and stop and refocus, respectively.[9] The goal is to increase the situational awareness of the entire team about the plans and their respective colors. This workflow execution and progression is identified as a suggestion for intubation planning. This does not prevent that, for example, the team chooses to perform the first attempt directly by executing plan C, if this is the best option after their analysis.

Another simple, but fundamental safety instrument is the use of color-coded medication labels. In an emergency situation the medications must be quickly aspirated and most of the time, they are not clearly identified, which increases the risk to the patient. We proposed to the nurse team the use of pre-coded labeled stickers with the dilution of drugs, in order to facilitate the adherence to correct identification of syringes.

Checklists

Most checklists finish when the intubation is completed. We added a fifth part because severe complications may occur 15 minutes after the intubation,[23] thus the procedure does not finish when intubation is completed. Physicians have difficulties in adhering to checklists. In a five-year audit in the operating room, for example, the overall completion rate was only 60%.[24] It is likely that in the ED environment, adherence might be much lower.

We consider a differential of our checklist the accomplishment of a debriefing after the end of the airway management. Because it is considered a procedure that may have serious consequences, an immediate evaluation must always be done to identify factors that could be improved for the next intubation. By doing so, we can foster a safe space for improvement each time and then bring better care to the next patient. In addition to performing a pause during the shift and

decreasing the cognitive overload, the debriefing may represent a moment to observe the psychological needs of the individuals involved.[25,26]

Airway plans and materials

The use of airway plans aims to systematize the cognitive and technical aspects available in different airway management situations. Algorithms are not a rule, but rather a suggestion for action. It is important to emphasize that the algorithms presented do not simplify the complexity of airway management in a few phrases and images. Therefore, they should only be used as a guide.

There are different blades and tube sizes in the green drawer. There is more than one handle in case of malfunction. Spare batteries are fundamental for the handles. There is one capnography kit as it is the gold standard for confirming intubation. Surgical pen is used to delineate the cricothyroid membrane, one of the first steps. Magill forceps should be use in the case of a foreign body. Lidocaine spray and gel are present for lubrification of the tube and if an awake approach is chosen for airway management.

Two recent systematic reviews[27,28] showed a benefit of the video over the traditional laryngoscope and the use of the hyperangulated blade in difficult airways, increasing the first-pass rate.

The airway suctioning equipment includes flexible and rigid aspirators, as intubations performed in the emergency setting do not respect the optimal fasting time and often patients have large amounts of secretion and food debris in the airway. This content is not adequately removed by the common flexible aspirator; thus, the availability of a rigid aspirator is required.

Tube introducers (i.e., bougie) are usually seen as rescue devices in intubation. However, we included them in plan A/Green drawer because of recent evidence[29] that shows a significant increase in the first-pass rate. In addition, staff should be proficiently trained to use the materials when needed. We believe that using the bougie as rescue equipment shortens their learning curve.

Second generation LMA, those that are capable of draining gastric secretion and have a better local seal, must be present in the second drawer. Two units of each different size, in order to provide options for a better seal. The PEEP valve must be present in the kit for coupling to the BVM, as this improves alveolar recruitment and, consequently, oxygenation, the cornerstone of airway management.

Oropharyngeal and nasopharyngeal devices are fundamental for maintenance of airway patency, especially in an oxygenation rescue phase of management.

The cricothyroidotomy kit contains: a tray, two tracheal hooks, Metzenbaum scissor and a needle holder. It is stored inside the 3rd drawer. It is important to note that in the management of CICO situations, it is no longer acceptable to get the materials in a disorganized manner and at the time of the situation. The Plan C equipment in separate in kits, containing the devices described in the check table. This, in addition to organizing, facilitates the execution of the procedure, reducing cognitive overload and the stress of the situation.

Limitations

There are several limitations to the present work. First, this is a description of airway bundle development by a single center in Brazil, without any test comparing it with standard of care. Therefore, it is not superior to other airway bundles.

Second, it is not an implementation or an audit paper, thus changes may occur in the future once the bundle is fully implemented in our ED.

Third, many of the equipment available in our tertiary hospital-based ED may not be available in other institutions, especially those with less resources.

Fourth, some elements of our bundle such as the actual trolley, the use of a checklist for intubation and color codification do not have robust evidence to justify their use as standard of care. For example, the only randomized controlled trial that has evaluated the use of a checklist for endotracheal intubation of critically ill adults did not find changes on periprocedural outcomes or in mortality.[30] Nevertheless, we believe these elements are important because with a checklist and a structured plan all the airway team is on the same page for the procedure, the color-coded drawers set the tone and an organized trolley helps nurses to get and check materials faster.

CONCLUSION

By using the multiple tools presented in this bundle, we believe it is possible to optimize airway management in the Emergency Department. Unlike most of the available resources in the literature that describe a difficult airway trolley, the prototype presented here is aimed to be routinely used in all intubations since every emergency intubation can become a difficult

airway, even though there are no clear predictors for this. Importantly, every Emergency Department should have its bundle adjusted to their local needs and to their resources in order to reduce adverse events related to this procedure.

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Case Report

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Medical air transport crash: Case report of crisis/ emergency management by a flight nurse

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ABSTRACT

Though medical air transport is a fast-developing field, no specific regulations have been formulated regarding the training and skills required by the health professionals involved in aeromedical missions, especially emergency nurses. Despite the potential benefits observed in case- and simulation-based training, there is a lack of evidence suggesting that a complete team training in all emergency skills leads to improved prognosis in a critical situation. Regarding non-technical skills, the repeated simulations of crisis resource management skills (problem solving, situational awareness, resource utilization, communication, and leadership) for nurses are associated with better knowledge retention. However, there is little demonstration of their relevance in improving the patient's prognosis in real care situations. This paper is a case report of a medical air transport crash during the outbound segment of the flight. The aircraft sustained serious damage, and many of the crew were injured. The flight nurse was responsible for providing care to the other crew members, managing decision-making in life-threatening situations, and sharing information with the professionals on board the aircraft as well as with the rescue team. This report aims to demonstrate the importance of flight nurses and other medical crew (such as flight physicians and physiotherapists) being proficient in aircraft emergency procedures and receiving effective crisis resource management training.

Keywords: Emergency nursing; Crew resource management, healthcare

INTRODUCTION

Approximately 3% of all medical transports are performed by aircraft in the United States of America.[1] Medical air transport is the major alternative used for shifting critically ill patients between states and countries.[2] Usually, the level of care provided, and complexity of procedures performed by air medical crews demand the presence of a flight physician. Moreover, very few descriptions of regulations and essential requirements in case of non-doctor competencies are available.[3] The role of the flight nurse in the medical air multi-professional team includes updating and ensuring compliance with the aircraft's medical equipment checklist, having knowledge of the patient's clinical conditions and case, monitoring the patient, and following medical recommendations.[4] Despite the potential benefits observed in case- and simulation-based training, there is a lack of evidence that complete team training in all emergency skills leads to improved prognosis in a critical situation.[5]

Emergency staff usually face multiple diagnostic challenges, resource limitations, and disruptions in work environments.[6] To deliver the best patient care

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in chaotic situations, health professionals must follow coordinated team-based strategies directed by crisis resource management (CRM) principles.[7] Interestingly, CRM behavioral skills were initiated into aviation in the 1970s and were progressively incorporated into medical practice.[8] Accordingly, nurses are expected to demonstrate shared leadership during crisis, with appropriate decision making capabilities and emotional intelligence skills, so that emergency care culminates in the best possible prognosis for the patient.[9] Education through repeated simulations of CRM skills (problem solving, situational awareness, resource utilization, communication, and leadership) for nurses is associated with the retention of knowledge, but there is little demonstration of its relevance in improving the patient's prognosis in real care situations.[10]

This paper is a case report of an air medical transport crash during the outbound segment of the flight (on the way to pick up the patient). The accident occurred during landing at the Juscelino Kubitschek Airport (ICAO designation SNDT), in the city of Diamantina, the state of Minas Gerais, Brazil. The plane had a runway excursion and fell off a cliff, right after the end of runway 21.

Serious damage occurred to the aircraft, and many of the crew were injured. The flight nurse, who had also sustained critical injuries, was responsible for providing care to the other crew members, managing decision-making in that life-threatening situation, and sharing information with professionals inside the aircraft as well as the rescue team. All victims had good outcomes, essentially due to the initial care they received.

This report aims to demonstrate how important it is for the flight nurse, as well as the other medical crew (such as flight physicians and physiotherapists), to be proficient in aircraft emergency procedures and receive effective CRM training. A retrospective compilation of data from the crash and rescue records has been carried out, with subsequent exposure of the main findings.

CASE REPORT

A Bombardier LearJet 31, configured for medical air transport, took off from the city of São Paulo (São Paulo, Brazil) bound for the city of Diamantina on 2 January 2021, to transfer a critically ill patient back to São Paulo. The crew was composed of two pilots, one emergency physician, and one flight nurse.

While landing at the Diamantina airport, the aircraft was not able to lose speed properly (for reasons yet to be disclosed) and ended up having a runway excursion and falling off a cliff located a few meters away from the end of runway 21. During maneuvers for landing, the aircraft missed the runway and landed in a ravine. The impact occurred with the aircraft tilting its nose down when meeting the end of the track, after being in a horizontal position on the land, already decelerating, at an estimated speed of 80 knots. All passengers wore a three-point seat belt, chest, and hip buckle. The engines remained on, and major structural damage occurred internally (**Figures 1 and 2**). There was no explosion. The posterior evaluation showed that all aircraft documentation was up to date and adequate. These considerations certainly also contributed to a better outcome of the accident.

The following statement was made by the first author of this article, who was the flight nurse of this mission:

> I did not lose consciousness at any time after the impact. At first sight, there was a big mess inside the aircraft. Immediately, I noticed an injury with profuse bleeding on my forehead; I had a severe headache and felt intense pain in several locations such as my right eye, back, and left thigh. I had no trouble breathing and was able to move all four limbs. The engine noise was loud, and there was no adequate lighting. Despite the presence of fog, I was able to establish eye contact with the other crew members. As there was a high chance for an explosion to follow, the first thing to do was try to abandon the aircraft. The front main exit was destroyed, so I unlocked the rear emergency exit. I managed to get out over the right wing, receiving debris and dust from the engine's jet blast. This was the only possible way out available at that time. Outside the aircraft, I looked for the other crew members, but no one had been able to abandon ship. At this point, I realized that I would have to apply the START (Simple Triage and Rapid Treatment) method to evaluate my colleagues, to define the treatment and transport priorities, as I was the only one among them effectively equipped to provide any emergency care.
>
> Inside the cabin, in the front, I found the flight physician. She was conscious and able to walk, so I directed her to the emergency exit, helping her to exit the aircraft safely. I moved her away from the risk area, and she remained in rest. Soon after, the pilot also found the exit. He had a severe cough and speech trouble, but it was possible to understand his message: 'the co-pilot remains entrapped in the cockpit!'. Despite the pilot's reported symptoms inferring soot poisoning, he was also classified as a 'green' victim according to the START method. I guided him away from the airplane, for him to breathe fresh air. Soon after, I spotted the co-pilot trapped in his seat. He made movements but was unable to communicate. From that

Source: authors.

Figure 1. External and internal images of the medical air transport crash.

Source: authors.

Figure 2. Internal rear view of the aircraft after the accident.

moment on, all efforts were made to remove this victim. There was no access from within the plane. At this moment, the physician approached and offered help. We tried to break the front window with our own hands, but without success. The pilot returned after a few minutes feeling better and, in a desperate attempt to help, found a metal bar near the crash site and tried to break the window with it. However, that piece of metal was extremely hot and, as a result, he ended up with severe burns in both hands. There were no other tools to clear the way to the cockpit.

Without further options to help, I climbed the cliff from which we had fallen off, to seek help. The airport was located on top of the cliff but, unfortunately, it did not have a fire station, due to its small size and traffic movement. A single motorcyclist approached at the time and I shouted: 'My aircraft has crashed, I need a sledgehammer to break the cockpit glass.' Fortunately, he lived a few meters away, and gave me a lift. We went to his residence and took all possible instruments to break into the cabin. I returned to the scene but, despite using all these instruments, there was no success in our attempts to break the window. The co-pilot was already unconscious.

The pilot entered the aircraft again and, after much effort, opened the cockpit door and managed to free the co-pilot from the wreckage, pulling him out. Both fell unconscious inside the cabin at that time. I then managed to remove them from inside the aircraft and, once outside the airplane, I started clinical evaluation of the co-pilot following the XABCDE technique: there was no apparent major bleeding, I opened the airways with smooth chin lift with clear visible permeability, and there were clear symmetrical chest expansion and breathing movements. The radial pulse was palpable, strong, and full. I had no other medical devices to initiate any type of immobilization or assistance. Considering the high risk of explosion, I stopped evaluation at this point and opted to move him away from the site, using quick removal techniques. After that, I returned to find the pilot, who had been supported by the physician and remained lying on the ground near the aircraft, with patent airways, respiratory movements, and eyes wide open. In a brief period of time, the co-pilot recovered consciousness. The priority at this point was to leave the area. I positioned everyone as far from the aircraft as I could and took the portable oxygen cylinders with me, to reduce the risk of explosion.

After a few minutes, the city's local Emergency Medical Service team got on site. Before I was examined, I reported the clinical conditions of the crew to the rescuers and suggested the priorities for evaluation. I was taken to a hospital nearby and diagnosed with rib, spine, and leg fractures and a subdural hematoma—all of these were treated using conservative treatment methods.

DISCUSSION

Conceptually, emergency nurses play a key role in performing teamwork, thus increasing the efficiency and safety levels of the care provided to the patient.[11] However, the practical implementation of this concept faces several difficulties. Despite the evidence supporting the need for certified courses in emergency training for critical care nurses, there is, in general, a lack of clarity about emergency nurse titles, education, skills, and competencies, given the vast professional heterogeneity.[12,13] Furthermore, the regulation of nursing practices varies in different countries and this can confuse professionals who study international policies.[14] Therefore, a clear understanding of the field of action is essential for safe nursing practices. In addition to technical skills, the development of behavioral skills can also improve teamwork.[15] For example, a systematic review of nurse–physician communication, especially in emergency situations, concluded that the teamwork skill is crucial yet inadequately addressed.[16] Ideally, both technical and behavioral issues must be addressed before the implementation of advanced nurse practices.

Brazilian civil aviation agency (Anac, acronym in Portuguese of *Agência Nacional de Aviação Civil*) does not have specific regulations regarding the training and skill requirements for health professionals involved in aeromedical missions. Despite the crucial role played by nurses and physicians in these missions, they are actually considered as "passengers" by this regulatory agency. On the other hand, the national Ministry of Health has published a document that describes the curriculum that is intended to be taught to all health professionals who are to take part in medical air transport.[17] As stated in this document, the training program should comprise subjects as "normal and emergency procedures during flight," "safety inside and around the aircraft," and "emergency evacuation." These are part of the minimal training required for the medical staff (nurses and physicians) and are supposed to be covered within a ten-hour course.

When it comes to CRM training, none of the agencies has specific recommendations for health professionals. The Ministry of Health does not consider it a part of the minimal required training. Anac, despite instituting regulations on this topic, does not consider health professionals as crew members. Hence, it is not mandatory for nurses and physicians to participate in CRM training programs.[18] Although there is no formal requirement, several Brazilian air patient transport companies perform continuous nursing training.

Usually, the focus is primarily on identifying and controlling damage collateral, flight safety, and emotional management of the stress induced by the aeromedical operation. Some companies train the crew in Air Medical Resource Management based on Federal Aviation Administration guidance.[19] This specific training addresses minimum skills related to everyday situations management.

It is of paramount importance that all medical staff be trained and familiarized with emergency procedures that could be performed during aeromedical missions. Both technical and non-technical (CRM) nursing skills should be developed, as they are to be applied in each phase of the mission, especially when some unexpected emergency occurs, as in this extreme case of an airplane crash during landing. Bureaucratic nursing professionals with little involvement in their roles would certainly not be able to perform the reported actions with such accuracy.

Flight nurses are formally trained and have certifications in some countries like the United States, Canada, United Kingdom, and Germany. This is a way of homogenizing the performance of these professionals in specific skills related to the multiple particularities of aeromedical transport.[20]

Also necessary is the public consultation of released reports by the National Transportation Safety Board of several medical air transport accidents. These data should be applied to safety culture, suggesting improvements and preventing new incidents.[21]

Therefore, this report demonstrates the importance of emergency staff who are well trained in technical skills and behaviors, thus re-emphasizing the need to expand training and certifications, especially among emergency nurses.

Emergency nurses must have situational awareness and the ability to make appropriate decisions in critical situations. This reflects the need for constant practice and training, along with strong technical knowledge.

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Case Report

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Prinzmetal angina: a case report

Angina de Prinzmetal: um relato de caso

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ABSTRACT

Prinzmetal angina occurs due to a focal spasm of an epicardial coronary artery, causing severe myocardial ischemia. Smooth muscle contractility disorders may be related to a cause of the disease, however, this is not yet well defined in the literature. The prognosis might be benign, and this case report is an important means for disseminating knowledge about decision-making and describing the diagnostic process and therapeutic approaches. Despite being a rare type of angina, it has considerable challenges, which, if left untreated, can produce severe consequences in the patient's life. It was possible to observe that chest pain related to causes worsening in the patient's quality of life and the possibility of causing myocardial infarction, arrhythmia even sudden death.

Keywords: Case reports; Diagnosis; Therapeutic approaches; Prognosis

RESUMO

A angina de Prinzmetal ocorre devido a um espasmo focal de uma artéria coronária epicárdica, causando isquemia miocárdica grave. Distúrbios de contratilidade do músculo liso podem estar relacionados àcausa da doença, entretanto isso ainda não está bem definido na literatura. O prognóstico pode ser benigno, e o relato deste caso é um importante meio para a difusão de conhecimentos a respeito do tema angina de Prinzmetal, descrevendo o processo diagnóstico e as condutas terapêuticas. A angina de Prinzmetal, apesar de ser uma variante rara de angina, possui gravidade considerável que, se não tratada, gera consequências severas na vida do paciente. Ela provoca piora na qualidade de vida do paciente, devido à dor e pela possibilidade de causar infarto miocárdio, arritmia e até mesmo morte súbita.

Descritores: Relatos de caso; Diagnóstico; Condutas terapêuticas; Prognóstico

INTRODUCTION

Prinzmetal angina occurs due to a focal spasm of a coronary artery, located in the epicardial region, and may cause severe ischemia in the myocardium. Coronary artery vasospasm is an exacerbated and nonspecific but reversible response of the

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contractility of the smooth coronary artery muscle in response to various stimuli. Spasm is believed to occur in arteries without stenosis, but most cases, referring to this form of angina, are related to the presence of spasms as a result of atheromatous plaques. Among the symptoms of PA, typical chest pain located in the retrosternal region, usually at rest, can be mentioned. Alcohol, psychological stress, hyperventilation, exposure to cold, psychostimulants, such as cocaine are triggering factors of the disease, and the main trigger is smoking.[1-3]

The exact cause of the disease is not well defined, however, it may be related to smooth muscle contractility disorders due to vasoconstrictors cytokines, leukotriene, or serotonin. The gold standard diagnosis is the provocative test, in which intravenous injection of vasoconstrictive substances causing coronary spasms such as acetylcholine, methylergonovine, or ergonovine-induced chest pain. Generally, an exercise test is performed to compare the parameters of the patient at rest and to physical stress. In this diagnostic test, analysis of the ST segment of electrocardiogram during an episode of chest pain (which, in normal situations can be at rest nd usually in the morning), occurs as a reaction to the provocative substances. The main forms of treatment for patients with PA are the use of nitrates and calcium channel blockers. Thus, to quickly cease an episode of angina, sublingual or intravenous nitroglycerin is used, while long-action nitrates are used to decrease the number of anginal episodes.[4-7]

The prognosis of this form of angina may be relatively benign, provided that patients are on vasodilator therapy and avoid smoking and alcohol intake. However, PA crises may require hospitalization for more delicate care, and many complications can be fatal, such as acute myocardial infarction, ventricular arrhythmias, and sudden death. Despite the clinical importance of PA, the incidence of this disease is little known, knowing only that it is substantially less common than typical angina, whose cause is related to atherosclerotic coronary stenosis. Refractory chest pain may include a surgical or percutaneous approach. Advanced age, low medication ideation, diabetes mellitus, hypertension, and low family income are risk factors for complications in patients with PA.[1,8-10]

Therefore, given the importance of this theme, the present study aims to describe the diagnostic process and therapeutic approaches of a case of PA. The study was approved by the Ethics Committee of the University of Marília (CAAE: 58928621.5.0000.5491).

CASE REPORT

A 55-year-old brown male patient presented to a specialty outpatient clinic due to typical chest pain for 15 months. He reported chest pain in the retrosternal region, exercise induced for at least 30m, with intensity 10/10 and duration of 5 to 10 minutes, associated with fatigue, sweating, paresis in the right upper limb, and the sensation of cervical stiffening, with spontaneous improvement at rest.

The pain was associated with small daily efforts, such as brushing teeth, squatting, bathing, and evacuating. At the time, he sought care in a Basic Health Unit that guided treatment for reflux.

In the persistence of symptoms, after 3 months of treatment, he underwent a private consultation with a cardiologist and underwent catheterization, which identified a coronary spasm located in middle portion of the anterior descendent coronary artery. Beta-blockers (metoprolol), nitroglycerin, and calcium channel blocker (Diltiazem®) were prescribed.

Inniatily reported significant improvement related chest pain during the firsts 3 months following catheterization, but when performing intense physical exertion, in the 6 month of evolution, pain episodes became frequent again, limiting their work activity and occurring mainly after physical or emotional stress. Comorbidities included systemic arterial hypertension, sedentarism, history of past smoker and no history of cardiovascular or cerebrovascular disease.

On physical examination, the patient was in good general condition, with a blood pressure of 140x100mmHg, saturation at 98%, heart rate of 54bpm, and respiratory rate of 20bpm. Flat and healthy chest. Symmetrical expandability, painless palpation and symmetrical bilaterally, clear pulmonary sound to percussion, vesicular murmurs physiologically distributed to auscultation. Pulses present, full and symmetrical (radial, popliteal, tibial, and pedisal).

Based on these factors, the diagnostic hypothesis was Angina Prinzmetal. However, for diagnostic confirmation, complementary tests were performed. Thus, the patient was advised to maintain drug therapy and perform the following tests: exercise test (**Figures 1 and 2**), myocardial scintigraphy (MS) (**Figure 3**), and coronary angiography (**Figure 4**).

MS showed moderate perfusion abnormalities (10 to 15% of left ventricular mass) in the anterior wall and apex of the left ventricle, indicating moderate ischemia in these regions (**Figures 4 and 5**).

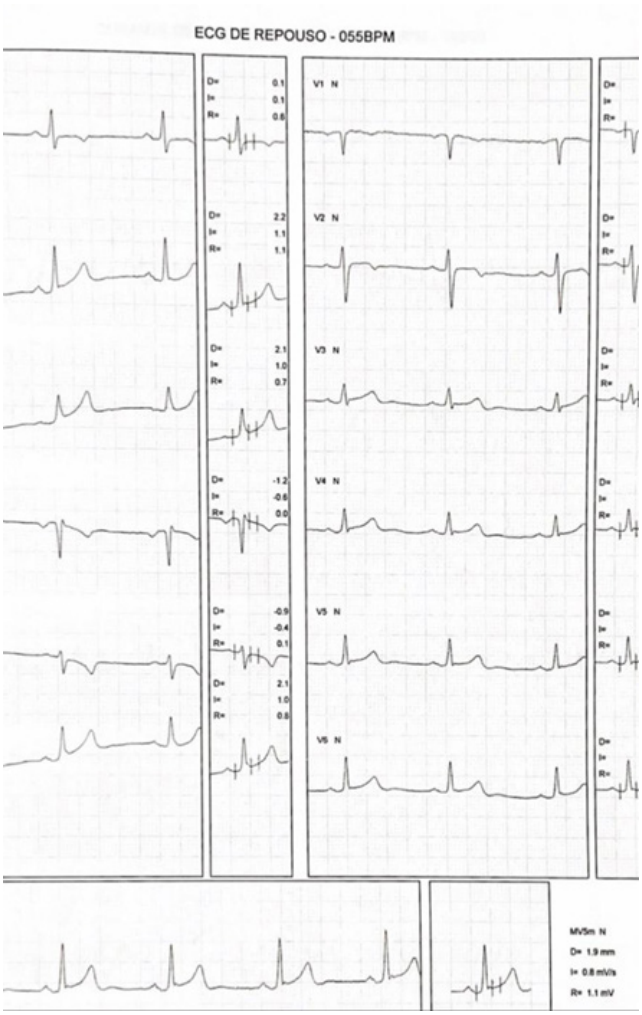

Figure 1. Exercise test at rest. The electrocardiogram indicated sinus rhythm with ventricular repolarization disturbance.

Figure 2. Exercise test after exertion. Electrocardiographic changed after exertion correspond to myocardial ischemic response patterns (ST elevation pattern).

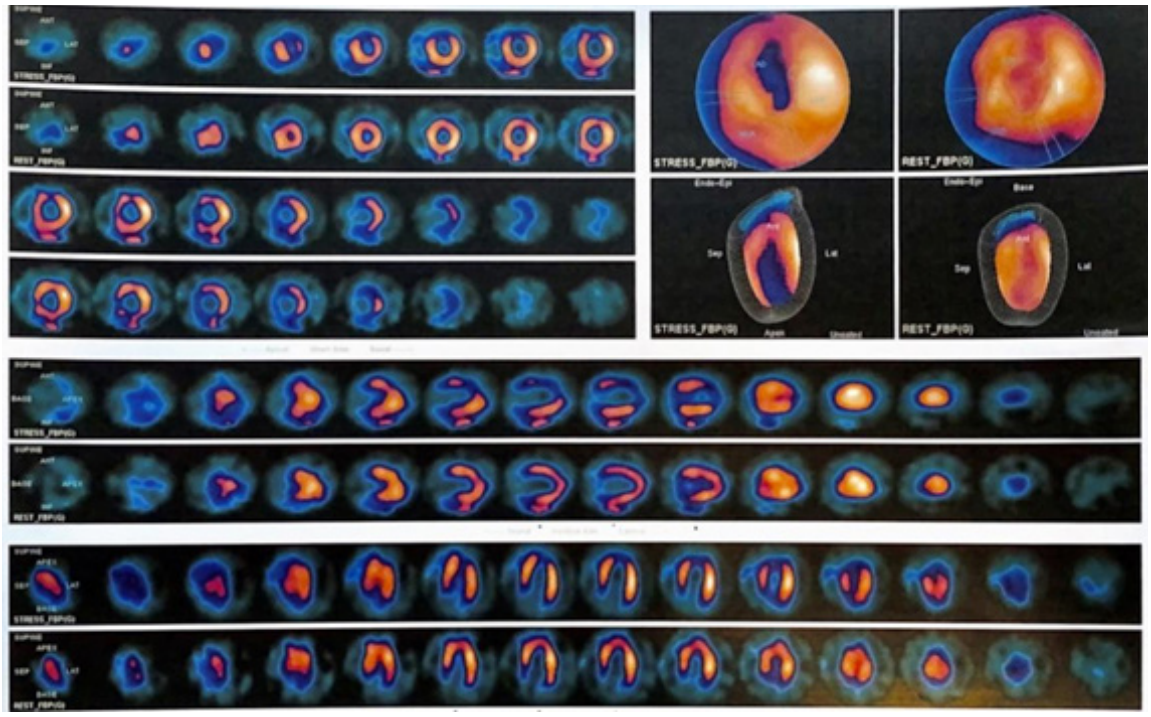

Figure 3. Myocardial scintigraphy was performed using Technetium Tc-99m sestamibi as the radiotracer pharmacological test. Concentration defects and perfusion abnormalities in the apical and anterior myocardial segments.

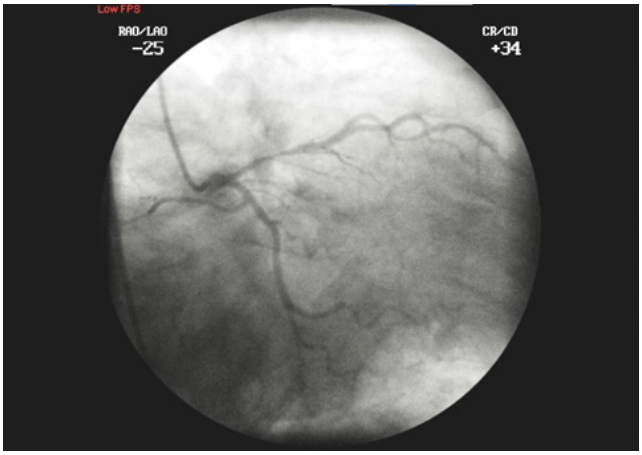

Figure 4. Left coronary artery with spasm. Coronary circulation without obstructive lesions and coronary spasms. Anterior descending artery reaches the middle third of the posterior interventricular groove with spasm in the proximal area.

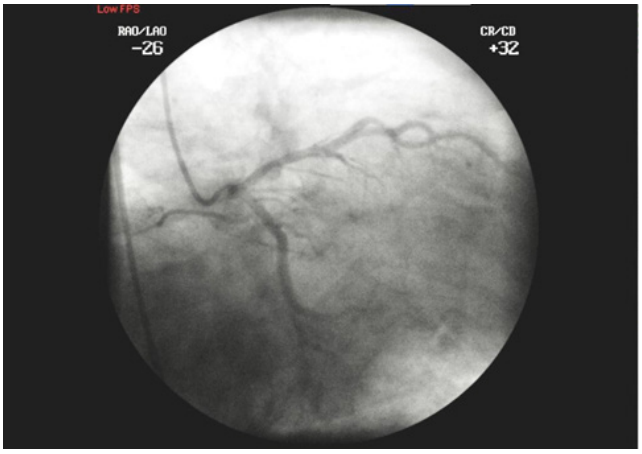

Figure 5. Left coronary artery post-injection of intracoronary nitroglycerin.

DISCUSSION

PA, also called vasospastic angina (VA) is caused by focal or diffuse coronary vasospasm, which results in severe temporary or persistent coronary artery obstruction. Risk and triggering factors such as smoking, alcohol use, stress, hyperventilation, and migraine, associated with autonomic nervous system disorders such as sympathetic and parasympathetic drugs influence the onset and intensity of manifestations. Excessive contraction of vascular smooth muscle, endothelial dysfunction, and magnesium deficiency have also been reported as contributors to the occurrence of vasospasm in patients.[11,12]

The tests performed with the patient in the case indicated that his spasm occurred in situations of physical and emotional stress, besides being caused in reaction to the provocation with dipyridamole, for about 4 minutes. In addition, the patient presents risk factors, since he was a former smoker, and a social alcohol consumer and reported stressful situations at work.

The literature indicates that the classical symptoms include typically anginal pain, oppressive with irradiation to the shoulder, mandible, inner face of the arm, and effort, whose relief occurs at rest and/or nitrate use. The patient had a clinic that differed from the literature since his symptoms include chest pain at slight exertion, weakness in the right upper limb, sweating, and a feeling of cervical stiffening.[13,14]

The gold standard diagnosis used in these cases is made from pharmacological provocative tests with a bolus of high doses of acetylcholine, methylergonovine, or ergonovine, by intracoronary injection. To determine the diagnosis, the Coronary Vasomotion Disorder International Study Group (COVADIS) created three criteria:

- Response to nitrate in the occurrence of spontaneous anginal episodes with at least one of the following: (a) angina at rest, especially between night and dawn; (b) with variable exercise tolerance and worse in the morning; (c) hyperventilation precipitates the episode; (d) calcium channel blockers (but not beta-blockers) suppress episodes.
- Transient ischemic disorders that include at least two adjacent leads with ST-segment elevations ≥ 0.1mV, ST-segment unevenness ≥ 0.1mV, or new negative U waves.
- Spontaneous coronary vasospasm or in response to provocation tests.[15]

The patient had a spasm of the anterior descending coronary artery, in its initial part during coronary angiography, in addition, the patient reported that one of the factors of the improvement of symptoms was rest, and his exercise test indicated electrocardiographic alterations consistent with the criteria of COVADIS.[15] Thus, his clinic and tests covered all three criteria for the diagnosis of PA.

Cardiac rehabilitation and physical training with behavioral therapy are the main pillars of treatment. Medications include calcium and nitrate channel blockers, and calcium channel blockers are preferred due to concerns that long-acting nitrates may develop nitrate intolerance. However, combination therapy with calcium and nitrate channel blockers can synergistically

provide relief in patients with single-agent refractory AV. Statins and angiotensin-converting enzyme (ACE) inhibitors demonstrate efficacy in preventing episodes of vasospasms and should be considered in all patients presenting with this condition.[9,16,17]

The patient studied was being treated with beta-blockers, nitroglycerin, and calcium channel blocker, medications that were adapted in dose and number of shots according to his clinic, to minimize symptoms.

Invasive treatments include stent placement, implantable cardio defibrillators (ICD), and partial sympathetic denervation. These options depend on the situation. For example, stent placement is a reasonable option in patients with persistent vasospasm due to arterial injury. On the other hand, ICD implantation can be considered for secondary prevention in patients with cardiac arrest secondary to VA. A recent publication suggested that in some patients with coronary vasospasm who have been successfully resuscitated from ventricular fibrillation or interrupted ventricular tachycardia, medical therapy with a BCC in combination with an ICD may be effective in reducing recurrent ventricular arrhythmias.[4,18]

Although VA rarely has manifestations, such as ventricular arrhythmias, patients have a higher risk of sudden cardiac death or of presenting the following risk factors: hypertension, hyperlipidemia, multivessel spasm, and spasm involving the left anterior descending artery. In the case of the patient studied, hypertension is a persistent risk factor, in addition to physical and emotional stress and previous involvement of the anterior descending artery.

In conclusion, PA is a condition that needs universal diagnostic criteria related to the spectrum of chest pain. Awareness of healthcare professionals is mandatory to decrease adverse outcomes such as myocardial infarction, arrhythmia, and sudden death. Despite medical, surgical, and pharmacological treatments, the correct understanding of this disorder will guide new treatments and pathways to improve treatments and perhaps achieve better clinical outcomes.

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Brief Communication

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Patterns of direct-to-consumer geriatric urgent care by telemedicine during the Covid-19 pandemic

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INTRODUCTION

Telemedicine can provide safe and convenient health care during social isolation measures adopted to tackle the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic.[1,2] These digital approaches have arisen out of a need to shield vulnerable patients from being exposed to the risks of coming into hospital, promoting social distances and protecting staff.[2] The older adults represent a specific cluster of patients at high risk of developing Covid-19 with rapidly progressive clinical deterioration[3] and discontinuity of chronic treatment. However, despite multiple conceptual advantages of remote older adult care, this population's interaction with telemedicine technology and limitations, such as hearing loss,[4] cognitive impairment, or visual loss, may compromise this mode's effectiveness.

We analyzed the usage pattern of telemedicine consultations in the older adult population 6 months before and after the start of the coronavirus disease 2019 (Covid-19) pandemic and the differences in teleconsultation characteristics between the elderly and adult population.

METHODS

An observational, single-center, retrospective study was conducted at the Telemedicine Center of the Hospital Israelita Albert Einstein, São Paulo (SP), Brazil. From September 2019 to August 2020, 1,684 patients aged 65 years or more and 78,836 patients aged between 20 to 64 years were enrolled. Data were extracted from electronic health records generated during the telemedicine encounters. This studt was approved by the ethics committee of Hospital Israelita Albert Einstein (REC number: 33706820.2.0000.0071)

The consultations were divided into two groups: 6 months before the pandemic (September 1st, 2019 to February 29th, 2020) and after the pandemic (March 1st, 2020 to August 31th, 2020). The diagnosis of Covid-19 suspect cases was defined according to World Health Organization (WHO) criteria. We analyzed overall

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performance and compared the following clinical characteristics: age, gender, encounter duration, unplanned return rate, antibiotic prescription rate, and final recommendation from the teleconsultant (discharge, non-urgent referral, Emergency Department [ED] urgent referral, terminated due to technical problems, or other). For numeric variables, Kolmogorov-Smirnov tests were applied. For non-normal distributions, log(n) was performed. A student *t* test was conducted for mean comparison between groups. Cramér's V was performed to compare categorical variables. When table cells count were under five, Fischer's exact test was performed. A p-value of <0.001 was considered significant. The database was analyzed by IBM Statistical Package for the Social Sciences (SPSS) version 22 software.

RESULTS

At the beginning of the pandemic, we observed a significant increase in older adult patients utilizing the service. Among all clinical characteristics analyzed, only the final recommendation changed after pandemics: a significant decrease in ED referrals and an increase in discharges. Telemedicine performance in the older adult population could be evaluated as being satisfactory, with a 27.5% ED urgent referral rate, low unplanned return rate (8.5%), and an adequate antibiotic prescription rate (6.2%) **(Table 1)**.

Antibiotics were used in 6,2% of the cases due to treatment of acute diarrhea (0,8%), dermatologic infection (0,7%), acute sinusitis (0,8%), urinary tract infections (0,8%), upper respiratory infection (0,1%) and others causes (3,0%).

Among Covid-19 suspects, the consultation duration was significantly higher in the older adults (19 minutes and 5 seconds *versus* 16 minutes and 58 seconds; $p < 0.001$) as well as ED urgent referrals rate (33.3% *versus* 20.6%; $p < 0.001$). Unplanned return and discharge rates were lower in the older adult group – 9.8% *versus* 16.4%, $p< 0.001$ and 62.7% *versus* 75.0%, $p < 0.001$, respectively. There were no differences in sex, nonurgent referrals rates, termination due to technical problems, and antibiotic prescription rates **(Table 2)**.

DISCUSSION

Video-based consultations had a high satisfaction rate among patients and physicians, with no differences in disease progression and lower costs when compared with face-to-face appointments.[5] The use of technology among older adults is increasing substantially with confidence in technology and positive attitudes towards online contact.[6,7] This new healthcare model, however, has brought the challenge of accelerating digital inclusion and standardization of care of these population.

Table 1. Demographic characteristics of older adults population (>65 years) before and after the Covid-19 pandemic

Variable	Before	After	p-value
Patients	42	1,642	
Age, years	71.52±5.8	72.65±7.2	0.667
Sex			
Female	21 (50.0)	796 (48.5)	0.979
Male	19 (45.2)	769 (46.8)	
Undefined	2 (4.8)	77 (4.7)	
Duration, minutes	00:18:49	00:20:54	0.332
Unplanned return rate	1 (2.4)	142 (8.6)	0.255
Antibiotic prescription	2 (4.8)	103 (6.3)	0.689
Final recommendation			<0.001
Discharge	17 (40.5)	929 (56.6)	
Non-urgent referral	5 (11.9)	228 (13.9)	
Technical problems	0	38 (2.3)	
ED urgent referral	17 (40.5)	446 (27.2)	
Other	3 (7.0)	1 (0.1)	

Results expressed as n, mean ± standard deviation or n (%).
ED: Emergency Department.

Table 2. Demographic characteristics of suspected Covid-19 patients

Variable	Adults	Older adults	p-value
Patients	27,832 (67.2)	327 (19.9)	
Age, years	34.3±9.3	71.5±6.7	<0.001
Sex			0.003
Female	14,860 (53.4)	148 (45.3)	
Male	12,070 (43.4)	161 (49.2)	
Undefined	902 (3.2)	18 (5.5)	
Duration, minutes	00:16:58	00:19:05	<0.001
Unplanned return rate	4,556 (16.4)	32 (9.8)	<0.001
Antibiotic prescription	262 (0.9)	3 (0.8)	0.999
Final recommendation			<0.001
Discharge	20,866 (75.0)	205 (62.7)	
Non-urgent referral	958 (3.4)	8 (2.4)	
Technical problems	270 (1.0)	4 (1.2)	
ED urgent referral	5,727 (20.6)	110 (33.3)	
Other	11 (0,1)	0	

Results expressed as n (%) or mean ± standard deviation.
ED: Emergency Department.

The longer consultation duration observed was probably due to the need for greater attention to procedures and routines to verify the existence of any hearing or comprehension difficulties, technological issues, or the need for the company of a family member, associated with the fact that these patients have multiple comorbidities.

Use of antibiotics in older adults were higher than in general population attended by telemedicine, inferring greater pattern of clinical severity and medical concern with possible worse prognosis.[8] Others causes than upper respiratory infections are related like dermatologic infections, acute diarrhea, acute sinusitis and urinary tract infections. Upper respiratory infections are among the most common acute illnesses leading to urgent consultations in emergency department at developed countries and account fora substantial economic burden. Its etiology is related by viruses and course being mostly self-limited. Meta-analyses and systematic reviews have found no role for prescribing antibiotics for its treatment, and such prescription may significantly increase the adverse event rates and potential harm.[9] In suspected Covid-19 patients the use of antibiotics were only 0.8% in older adults.

Evidence-based protocols for direct-to-patient urgent care by telemedicine consider higher age as a red flag for various conditions, leading to lower efficacy of this care model in the older adults. In fact, this study found a higher referral rate and lower efficacy of on-demand urgent care telemedicine encounters compared to that of young adults. The lower unplanned return rate cannot be explained by this tendency and could be due to a preference for face-to-face consultations. Notwithstanding, more than half teleconsultations were enough and helped avoid face-to-face appointments, which is highly desirable, potentially saving lives and minimizing contagion.

Thus, this study shows that, in a large older adults population living in a developing country, telemedicine consultation is a satisfactory solution to low-acuity health issues and can be enough for more than half Covid-19 suspect cases, though their resolution rates may be lower than that of young adults.

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Atovaquona-Proguanil para o tratamento da malária não complicada por Plasmodium falciparum

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Authors' declarations of interest
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INTRODUÇÃO

Em 2015 a Organização Mundial da Saúde (OMS) declarou que o atovaquona-proguanil pode ser usado em viajantes, e é uma opção em áreas endêmicas da malária em combinação com artesunato, como um tratamento alternativo nos casos em que não se tem um tratamento combinado com artemisinina (TCA) de primeira linha ou este não é eficaz. Esta revisão é uma atualização de uma Revisão Cochrane realizada em 2005.

OBJETIVOS

Avaliar a eficácia e segurança do atovaquona-proguanil (sozinho e em combinação com medicamentos com artemisinina) versus outros medicamentos antimaláricos para o tratamento da malária não complicada causada pelo *Plasmodium falciparum* em adultos e crianças.

MÉTODOS DE BUSCA

A data da última da busca por estudos foi em 30 de janeiro de 2020. Foram feitas pesquisas por estudos publicados no Registro Especializado de ensaios controlados do Grupo Cochrane de Enfermidades Infecciosas (Cochrane Infectious Diseases Group), CENTRAL, MEDLINE, Embase e LILACS. Para incluir estudos recentemente publicados e inéditos, também pesquisamos no ClinicalTrials.gov, o *meta*-Register of Controlled Trials e o Portal de Pesquisa da Plataforma Internacional de Registro de Ensaios Clínicos da OMS.

CRITÉRIO DE SELEÇÃO

Ensaios controlados aleatórios (ECAs) relatando dados de eficácia e segurança para o atovaquona-proguanil ou atovaquona-proguanil combinado com medicamentos com pelo menos um outro medicamento antimalárico para tratar a infecção não complicada causada pelo *Plasmodium falciparum*

COLETA DOS DADOS E ANÁLISES

Para esta atualização, dois autores de revisão extraíram novamente os dados e avaliaram a certeza das provas. Realizamos metanálises dos dados para calcular os riscos relativos (RRs) com intervalos de confiança (IC) de 95% para falhas de tratamento entre as comparações e para desfechos e segurança entre as comparações. As medidas de desfechos incluem falhas de tratamento não ajustadas e as falhas ajustadas por reação em cadeia da polimerase (PCR). O ajuste por PCR diferencia a nova infecção da infecção recrudescente.

PRINCIPAIS RESULTADOS

Dezessete ECAs preencheram nossos critérios de elegibilidade incluindo 4763 adultos e crianças da África, América do Sul e Sudeste Asiático. Oito ensaios relataram dados ajustados por PCR para distinguir entre infecção nova e recrudescente durante o período de acompanhamento. Neste resumo, relatamos apenas as comparações com os três anti-maláricos recomendados pela OMS que foram incluídos nestes ensaios.

Houve duas comparações com o artemeter-lumefantrina, um ensaio de 2008 na Etiópia com 60

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participantes teve duas falhas com o atovaquona-proguanil comparado a nenhum com o artemeter-lumefantrina (falhas no tratamento ajustado por PCR em 28 dias). Um segundo ensaio a partir de 2012 na Colômbia com 208 participantes teve uma falha em cada braço (falhas de tratamento ajustadas por PCR em 42 dias).

Houve apenas uma comparação com o artesunato-amodiaquina de um ensaio de 2014 realizado em Camarões. Houve seis falhas com atovaquona-proguanil em 28 dias e duas com artesunato-amodiaquina (falhas de tratamento ajustadas por PCR em 28 dias: 9,4% com atovaquona-proguanil comparado a 2,9% com artesunato-amodiaquina; RR 3,19, IC 95% 0,67 a 15,22; 1 RCT, 132 participantes; baixa certeza da evidência), embora tenha um número similar de falhas de tratamento não ajustado por PCR (9 (14.1%) com atovaquona-proguanil e 8 (11,8%) com artesunato-amodiaquina; RR 1,20, IC 95% 0,49 a 2,91; 1 RCT, 132 participantes; baixa certeza da evidência).

Houve duas comparações com artesunato-mefloquina de um ensaio de 2012 na Colômbia e um ensaio de 2002 na Tailândia, onde há altos níveis de malária multi-resistente. Houve números similares de falhas no tratamento ajustado por PCR entre grupos em 42 dias (2,7% com atovaquona-proguanil comparado a 2,4% com artesunato-mefloquina; RR 1,15, 95% IC 0,57 a 2,34; 2 RCTs, 1168 participantes; alta certeza da evidência). Houve também falhas similares de tratamento não ajustado por PCR entre grupos (5,3% com atovaquona-proguanil comparado a 6,6% com artesunato-mefloquina; RR 0,8, 95% IC 0,5 a 1,3; 1 RCT, 1063 participantes; baixa certeza da evidência).

Quando o atovaquona-proguanil foi combinado com o artesunato, houve menos falhas de tratamento com e sem ajuste de PCR em 28 dias (falhas de tratamento ajustadas por PCR em 28 dias: 2,16% com atovaquona-proguanil comparado a nenhuma falha com artesunato-atovaquona-proguanil; RR 5,14, 95% IC 0,61 a 43,52; 2 RCTs, 375 participantes, evidência de baixa certeza) e em 42 dias (falhas de tratamento ajustadas por PCR no em 42 dias: 3,82% com atovaquona-proguanil comparado a 2,05% com artesunato-atovaquona-proguanil (RR 1,84, 95% IC 0,95 a 3,56; 2 RCTs, 1258 participantes,moderada certeza da evidência). No ensaio de 2002 na Tailândia, houve menos falhas de tratamento no grupo artesunato-atovaquona-proguanil em comparação com o grupo atovaquona-proguanil em 42 dias com o ajuste de PCR.

Embora houvesse algumas pequenas diferenças nas quais os eventos adversos eram mais frequentes nos grupos atovaquona-proguanil em comparação com os medicamentos comparadores, não havia associações recorrentes para sugerir que o atovaquona-proguanil está fortemente associado a qualquer evento adverso específico.

CONCLUSÃO DOS AUTORES

O Atovaquona-proguanil foi eficaz contra a malária *P falciparum* não complicada, embora em alguns casos as taxas de insucesso do tratamento estivessem entre 5% e 10%. A adição de artesunato ao atovaquona-proguanil pode reduzir as taxas de falhas de tratamento. Artesunato-atovaquona-proguanil e o desenvolvimento da resistência aos parasitas podem representar uma área para pesquisas adicionais.

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Bloqueio nervoso periférico para as fraturas de quadril em adultos

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Authors' declarations of interest
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INTRODUÇÃO

Esta revisão foi publicada originalmente em 1999 e foi atualizada em 2001, 2002, 2009, 2017 e 2020. A atualização foi considerada necessária devido à alta incidência de fraturas do quadril, ao grande número de sociedades oficiais que fornecem recomendações sobre esta condição, à possibilidade que os bloqueios nervosos periféricos (BNPs) possam melhorar os desfechos dos pacientes e o importante papel que podem desempenhar os BNPs na redução do uso de opioides para analgesia no pré e pós-operatório.

OBJETIVOS

Comparar os BNPs usados como analgesia pré-operatória, como analgesia pós-operatória, ou como suplemento à anestesia geral versus nenhum bloqueio nervoso (ou bloqueio simulado) para adultos com fratura de quadril. Os desfechos foram dor no movimento aos 30 minutos da realização do bloqueio, estado de confusão aguda, infarto do miocárdio, infecção respiratória, morte, tempo para a primeira mobilização e custos de um regime analgésico para os bloqueios de injeção única.

A atualização foi realizada para buscar novos estudos e para atualizar os métodos e refletir os padrões Cochrane.

MÉTODOS DE BUSCA

Para a atualização da revisão pesquisamos as seguintes bases de dados: o Registro Central Cochrane de Ensaios Controlados (CENTRAL; 2019, Edição 11), na Biblioteca Cochrane; MEDLINE (Ovid SP, 1966 a novembro de 2019); Embase (Ovid SP, 1974 a novembro de 2019); e o Índice Cumulativo à Literatura de Enfermagem e Saúde Aliada (CINAHL) (EBSCO, 1982 a novembro de 2019), bem como registros de ensaios e listas de referência de artigos relevantes.

CRITÉRIO DE SELEÇÃO

Incluímos ensaios controlados randomizados (RCTs) avaliando o uso de BNPs em comparação com nenhum bloqueio nervoso (ou bloqueio simulado) como parte dos cuidados proporcionados a adultos de 16 anos de idade ou mais com fratura de quadril.

COLETA DOS DADOS E ANÁLISES

Dois autores da revisão selecionaram de forma independente, examinaram novos ensaios para inclusão, avaliaram a qualidade dos ensaios usando a ferramenta Cochrane Risk of Bias-2 e extraíram dados. Quando apropriado, agrupamos os resultados das medidas de desfecho. A certeza da evidência foi avaliada através da abordagem do GRADE.

PRINCIPAIS RESULTADOS

Incluímos 49 ensaios (3061 participantes; 1553 randomizados para BPNs e 1508 para nenhum bloqueio nervoso [ou bloqueio simulado]). Para esta atualização, adicionamos 18 novos ensaios. Os ensaios foram publicados de 1981 a 2020. Os autores dos estudos seguiram os participantes por períodos que variaram

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de 5 minutos a 12 meses. A idade média dos participantes variou de 59 a 89 anos. As pessoas com demência eram frequentemente excluídas dos estudos incluídos. A analgesia adicional estava disponível para todos os participantes.

Os resultados de 11 ensaios com 503 participantes mostram que os BPNs reduziram a dor no movimento dentro de 30 minutos do início do bloqueio (diferença média padronizada (DMP) -1,05, intervalo de confiança 95% (IC) -1,25 a -0,86; equivalente a -2,5 em uma escala de 0 a 10; alta certeza da evidência). O tamanho do efeito foi proporcional à concentração de anestésico local utilizado (P = 0,0003). Com base em 13 ensaios com 1072 participantes, os BPNs reduzem o risco de estado de confusão aguda (risco relativo (RR) 0,67, 95%IC 0,50 a 0,90; número necessário para tratar um desfecho benéfico adicional (NNTB) 12, 95%IC 7 a 47; alta certeza da evidência). Para o infarto do miocárdio, não houve eventos em um estudo com 31 participantes (RR não estimável; baixa certeza da evidência). De três ensaios com 131 participantes, os BNPs provavelmente reduzem o risco de infecção respiratória (RR 0,41, 95%IC 0,19 a 0,89; NNTB 7, 95%IC 5 a 72;moderada certeza da evidência). Com base em 11 ensaios com 617 participantes, os efeitos dos BNPs sobre a mortalidade dentro de seis meses são incertos devido à imprecisão muito grave (RR 0,87, 95%IC 0,47 a 1,60; baixa certeza da evidência). De três ensaios com 208 participantes, os BNPs provavelmente reduzem o tempo para a primeira mobilização (diferença média (DM) -10,80 horas, 95%IC -12,83 a -8,77 horas; moderada certeza da evidência). Um ensaio com 75 participantes indicou que pode haver uma pequena redução no custo dos analgésicos com uma única injeção de BNP (DM -4,40 euros, 95% IC -4,84 a -3,96 euros; baixa certeza da evidência).

Identificamos 29 ensaios em andamento, dos quais 15 foram publicados pela primeira vez ou pelo menos atualizados pela última vez após 1 de janeiro de 2018.

CONCLUSÃO DOS AUTORES

Os BNPs reduzem a dor no movimento dentro de 30 minutos após a realização do bloqueio, o risco de estado de confusão aguda, e provavelmente também reduzem o risco de infecção respiratória e o tempo para a primeira mobilização. Pode haver uma pequena redução no custo de analgésicos nos casos do BPN de injeção única. Não encontramos uma diferença para infarto do miocárdio e mortalidade, mas o número de participantes incluídos para estes dois desfechos foi insuficiente. Embora os ensaios clínicos aleatórios possam não ser a melhor maneira de estabelecer riscos associados a uma intervenção, nossa revisão confirma os baixos riscos de lesões permanentes associados aos BNPs, como encontrado em outras revisões.

Há alguns ensaios em andamento, mas não está claro se devem ser registrados mais RCTs, dados os benefícios encontrados. Ensaios não randomizados de boa qualidade com tamanho amostral apropriado podem ajudar a esclarecer os efeitos potenciais dos BPNs sobre o infarto do miocárdio e a mortalidade.

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