2019 Asthma school, Part I. Recent update of asthma guideline

Management of acute exacerbation

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Global Initiative for Asthma (GINA)

Updated 2019

CONTENTS

- Diagnosis of exacerbation
- Self-management of exacerbation
- Management in primary care
- Management in emergency department

Diagnosis of exacerbation

❖ **Exacerbation:** A change in **symptoms** and **lung function** from the patient's usual status

- **Severity** of exacerbation: lung function (PEF/FEV_1)
- **Onset** of exacerbation: frequency of symptoms

"Severe exacerbations are potentially **life-threatening**"

1. Self-management of exacerbation

1. Self-management of exacerbation

❖ **Written asthma action plans**

→ 모든 천식 환자에게 제공되어야 함
→ 천식의 급성 악화를 즉각 인식하고 대처할 수 있게 도움
→ 조절제/완화제/스테로이드 조절 요령 알려줌

❖ **Criteria for initiating an increase in controller medication**

→ 환자마다 기준이 다양
→ 평소 천식 조절 상태에 비해 임상적으로 의미있는 변화가 있을 때
(예. 정상 활동에 장애가 생기거나, **PEF가 2일 이상 20% 이상 감소**)

Emergency call

Well controlled

Getting worse

Severe

ASTHMA ACTION PLAN

Name: _____

Phone: _____

Action plan updated: M _____ / D _____ / Y _____

Bring this action plan to your doctor/nurse at each visit.

Doctor's Contact Details: _____

Nurse/Educator Details: _____

In an emergency call: _____

OR CALL AN AMBULANCE IMMEDIATELY.

YOUR EMERGENCY CONTACT PERSON

Name: _____

Phone: _____

Relationship: _____

IF YOUR ASTHMA IS WELL CONTROLLED

You need your reliever inhaler less than 3 times per week, you do not wake up with asthma and, and your asthma does not limit your activities (including exercise) (If used, peak flow over ____L/min)

Your controller medication is: _____ (name) _____ (strength)

Take: _____ puffs/tablet _____ times EVERY DAY

☐ Use a spacer with your controller inhaler

Your reliever/rescue medication is: _____ (name) _____ (strength)

Take _____ puffs if needed to relieve asthma symptoms like wheezing, coughing, shortness of breath

☐ Use a spacer with your reliever inhaler

Other medications: _____ (name) _____ (strength) _____ (how often)

_____ (name) _____ (strength) _____ (how often)

Before exercise take: _____ (name) _____ (strength) _____ (how many puffs/tablets)

IF YOUR ASTHMA IS GETTING WORSE

You need your reliever more often than usual, you wake up with asthma, or you cannot do your normal activities (including exercise) because of your asthma (If used, peak flow between ____ and ____L/min)

Take your reliever/rescue medication: _____ (name) _____ (strength) _____ (how often)

☐ Use a spacer with your controller inhaler

Take your controller medication: _____ (name) _____ (strength)

Take: _____ puffs/tablet _____ times EVERY DAY

☐ Use a spacer with your reliever inhaler ☐ Contact your doctor

Other medications: _____ (name) _____ (strength) _____ (how often)

IF YOUR ASTHMA SYMPTOMS ARE SEVERE

You need your reliever again more often than every 3-4 hours, your breathing is difficult, or you often wake up with asthma (if used, Peak Flow under____L/min)

Take your reliever/rescue medication: _____ (name) _____ (strength) _____ (how often)

Take prednisone/prednisolone: _____ (name) _____ (strength)

Take: _____ tablet _____ times every day

CONTACT A DOCTOR TODAY OR GO TO THE EMERGENCY DEPARTMENT

Additional comments: _____

ASTHMA ACTION PLAN

Name: _____

Phone: _____

_____

Action plan updated: M _____ / D _____ / Y _____

Bring this action plan to your doctor/nurse at each visit.

Doctor's Contact Details: _____

Nurse/Educator Details: _____

In an emergency call: _____

OR CALL AN AMBULANCE IMMEDIATELY.

YOUR EMERGENCY CONTACT PERSON

Name: _____

Phone: _____

Relationship: _____

Definition

Controller

Reliever

Others

IF YOUR ASTHMA IS WELL CONTROLLED

You need your reliever inhaler less than 3 times per week, you do not wake up with asthma and, and your asthma does not limit your activities (including exercise) (If used, peak flow over ____L/min)

Your controller medication is: _____ (name) _____ (strength)

Take: _____ puffs/tablet _____ times EVERY DAY

☐ Use a spacer with your controller inhaler

Your reliever/rescue medication is: _____ (name) _____ (strength)

Take _____ puffs if needed to relieve asthma symptoms like wheezing, coughing, shortness of breath

☐ Use a spacer with your reliever inhaler

Other medications: _____ (name) _____ (strength) _____ (how often)

_____ (name) _____ (strength) _____ (how often)

Before exercise take: _____ (name) _____ (strength) _____ (how many puffs/tablets)

Steroids

IF YOUR ASTHMA IS GETTING WORSE

You need your reliever more often than usual, you wake up with asthma, or you cannot do your normal activities (including exercise) because of your asthma (If used, peak flow between ____ and ____L/min)

Take your reliever/rescue medication: _____ (name) _____ (strength) _____ (how often)

❑ Use a spacer with your controller inhaler

Take your controller medication: _____ (name) _____ (strength)

Take: _____ puffs/tablet _____ times EVERY DAY

❑ Use a spacer with your reliever inhaler ❑ Contact your doctor

Other medications: _____ (name) _____ (strength) _____ (how often)

IF YOUR ASTHMA SYMPTOMS ARE SEVERE

You need your reliever again more often than every 3-4 hours, your breathing is difficult, or you often wake up with asthma (If used, Peak Flow under____L/min)

Take your reliever/rescue medication: _____ (name) _____ (strength) _____ (how often)

Take prednisone/prednisolone: _____ (name) _____ (strength)

Take: _____ tablet _____ times every day

CONTACT A DOCTOR TODAY OR GO TO THE EMERGENCY DEPARTMENT

Additional comments: _____

천식 행동지침

양호	행동지침
• 기침, 쌕쌕거림, 가슴답답함, 주야간 호흡곤란이 없다. • 일상활동에 지장이 없다. • 잠을 잘 잔다. • 증상완화흡입제를 일주일에 2번 이하 사용한다. • 최대호기유량이 개인최고치의 80%이상이다.	• 기존에 처방 받은 치료제를 유지하세요. (흡입제) _____( )번/회, 아침/저녁 _____( )번/회, 아침/저녁 _____( )번/회, 아침/저녁 (경구약) _____( ) 회/일, _____( ) 회/일 _____( ) 회/일, _____( ) 회/일 • 흡연과 원인 알레르겐 등 악화인자를 피하세요. • 정기적인 의사의 진료를 받으세요 • 운동 후 악화소견이 있다면 운동 15분 전에 증상완화제_____를 ( )회 흡입하세요.

주의	행동지침
• 기침, 쌕쌕거림, 가슴답답함, 호흡곤란이 있다. • 밤에 천식증상으로 잠에서 깬다. • 일상활동에 지장이 있다. • 증상완화흡입제를 일주일에 3번 이상 사용한다. • 최대호기유량이 개인최고치의 60%~80% 사이이다.	• 기존에 처방 받은 치료제를 지속하면서 증상이 호전될 때 까지 증상완화제를 추가로 사용하세요 • 증상완화제_____를 ( )번/회를 2~4회 흡입하세요. • 호전되면 ( )동안 매( )시간 마다 사용하세요 • 증상이 호전되지 않거나 양호로 돌아가지 않는다면 경구 스테로이드 ( )를 시작하세요. -용량 ( )알/회, 하루 ( ) -기간 ( )일 • 호전이 없거나 악화된다면 위험행동을 따라 하세요.

위험	행동지침
• 치료제가 도움이 되지 않는다. • 숨쉬기가 너무 힘들다. • 숨이 많이 차서 일상 활동을 할 수 없다. • 숨이 많이 차서 잠을 잘 수 없다. • 숨이 많이 차서 움직일 수 없다. • 숨이 많이 차서 말을 할 수 없다 • 손톱과 입술이 파랗다. • 최대호기유량이 개인최고치의 60% 이하이다.	• 경구 스테로이드 ( )를 시작하세요. 용량 ( )알/회 • 119 혹은 타인에게 도움을 요청하여 즉시 응급실에 방문하세요. • 동시에 병원에 도착할 때까지 증상완화제 _____를 20분마다 흡입하세요.

주의 및 위험시 각 행동지침에 의한 자가 치료 후에는 1-2주 안에 의사를 방문한다.

2014 대한 결핵 및 호흡기학회

천식 행동지침

성명:
주치의 :
악화인자 :
나의 최고호기유속 :

날짜 :
연락처 :

양호

기침, 천명 (쌕쌕거림), 가슴 답답함,
호흡 곤란이 없다.
일상적인 활동에 지장이 없다.
최고호시유속이 _____이상이다
(개인 최대치의 80%이상).

질병조절제를 다음과 같이 사용하세요.

조절제	용량	용법

필요 시 운동 전에 증상완화제 (벤토린) 를 흡입하거나
류코트리엔 조절제를 복용하세요.

주의

기침, 천명 (쌕쌕거림), 가슴 답답함,
호흡곤란 중 하나 이상의 증상이 있다.
밤에 천식 증상으로 잠을 깬다.
일상적인 행동에 지장이 있다.
최고호기유속이_____ 미만이다
(개인 최대치의 80% 미만).

현재 사용중인 약제를 지속하면서 증상이 호전될 까지 아래의 방법 중 한가지를 사용하세요.

□ 질병조절제_____를 사용하기 시작하세요.
□ 질병조절제 용량을_____까지 증량하세요.
□ 증상완화제 (벤토린) 를 각각 분사하여 2회씩 3번 혹은 네뷸라이저를 20분 간격으로 최대 3회까지 시행하세요.
□ 상기 치료로 증상 호전이 없을 경우 처방받은_____를 복용하고 담당 의사와 상의하세요.

위험

기침, 천명 (쌕쌕거림), 가슴 답답함,
호흡곤란이 '주의' 수준으로
처치 후에도 호전되지 않는다.
최고호기유속이_____ 미만이다
(개인 최대치의 60% 미만).

응급

숨이 차서 말을 하기 어렵다.
숨이 차서 움직일 수 없다.
입술이나 손가락 끝이 파랗게 변한다.

병원에서 제공받은 연락처로 연락하세요.

만일 '응급' 수준의 증상을 보이거나 매우 숨이 차면 즉시 119를 부르거나 응급실로 오십시오.

다음의 응급 처치를 동시에 시행하십시오.
□ 처방 받은 응급약 (경구제) 을 _____복용
□ 벤토린 흡입을 병원에 도착할 때까지 20분 간격으로 지속

2015 대한 천식 및 알레르기학회

1. Self-management of exacerbation

2018 GINA

1. Inhaled SABA
2. Inhaled corticosteroid
3. Combination
   ICS-formoterol

2019 GINA

1. Inhaled reliever (ICS-formoterol or SABA)
2. Combination ICS-formoterol
3. Other ICS and ICS-LABA
4. LTRA
5. Oral cotricosteroids

1. Self-management of exacerbation

1) Inhaled reliever medication

- **경증 천식 (as needed ICS-formoterol) 환자**

→ ICS-formoterol 증량

(단, 하루에 12번 흡입시 주의 [> 72 mcg formoterol])

- **SABA를 reliver로 처방 받은 천식 환자**

→ SABA 반복 사용 (단, ICS-formoterol 사용보다 효과 떨어짐)

→ SABA를 1-2일 이상 반복 사용하나 효과 없을 경우 내원

[SYGMA study]

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 17, 2018 VOL. 378 NO. 20

Inhaled Combined Budesonide–Formoterol as Needed in Mild Asthma

Paul M. O'Byrne, M.B., J. Mark FitzGerald, M.D., Eric D. Bateman, M.D., Peter J. Barnes, M.D., Nanshan Zhong, Ph.D., Christina Keen, M.D., Carin Jorup, M.D., Rosa Lamarca, Ph.D., Stefan Ivanov, M.D., Ph.D., and Helen K. Reddel, M.B., B.S., Ph.D.

Subjects

3849 asthma

GINA Step 2

Low dose ICS or LTRA + as needed SABA

Design

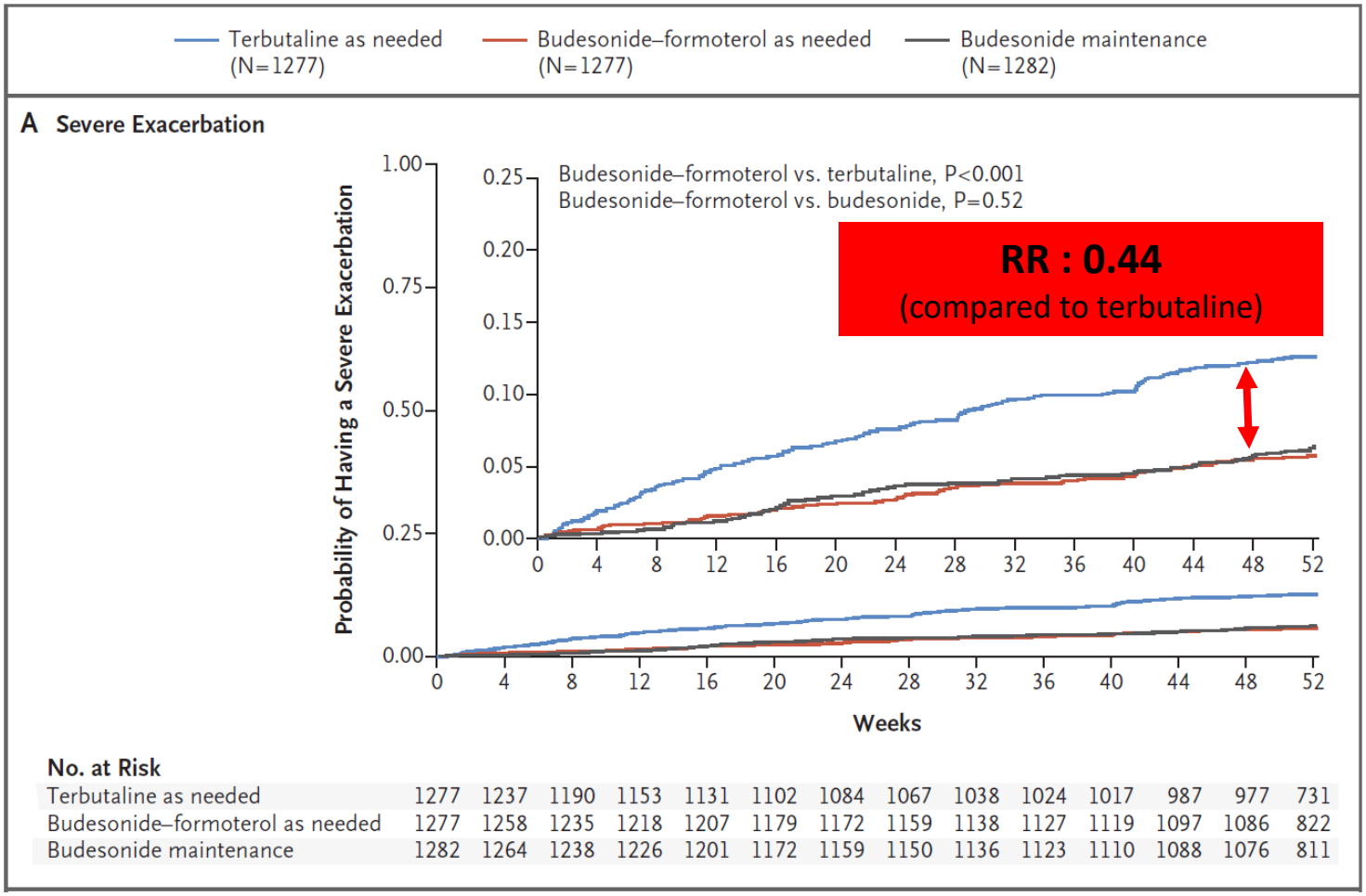
① Terbutaline as needed

② Budesonide-formoterl as needed

③ Budesonide daily + terbutaline as needed

O'Byrne et al. N Engl J Med 2018;378:1865-76

"Budesonide-formoterol as needed ≒ budesonide maintenance >> terbutaline as needed"



O'Byrne et al.
N Engl J Med
2018;378:1865-76

[Novel START study]

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Controlled Trial of Budesonide–Formoterol as Needed for Mild Asthma

Richard Beasley, D.Sc., Mark Holliday, B.Sc., Helen K. Reddel, Ph.D., Irene Braithwaite, Ph.D., Stefan Ebmeier, B.M., B.Ch., Robert J. Hancox, M.D., Tim Harrison, M.D., Claire Houghton, B.M., B.S., Karen Oldfield, M.B., Ch.B., Alberto Papi, M.D., Ian D. Pavord, F.Med.Sci., Mathew Williams, Dip.Ex.Sci., and Mark Weatherall, F.R.A.C.P., for the Novel START Study Team*

Subjects

668 asthma

GINA Step 1

SABA as needed

Design

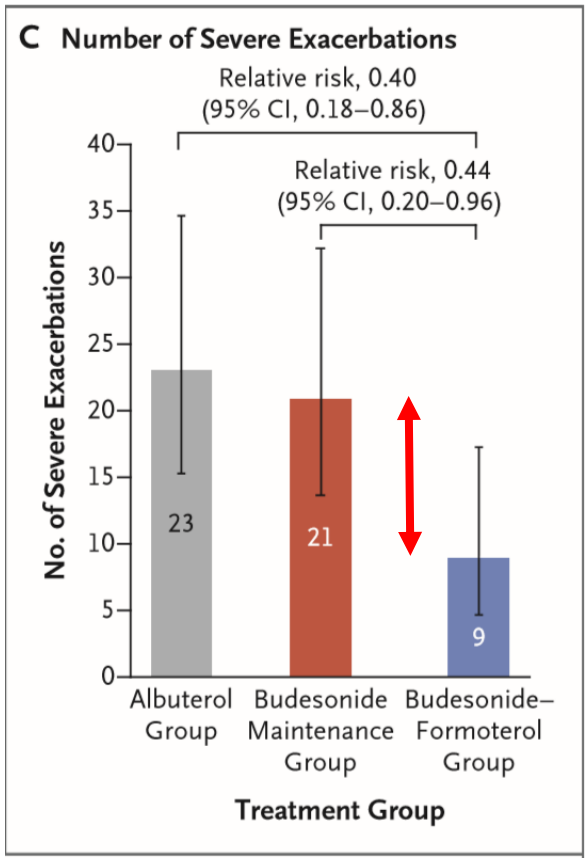
① Albuterol as needed

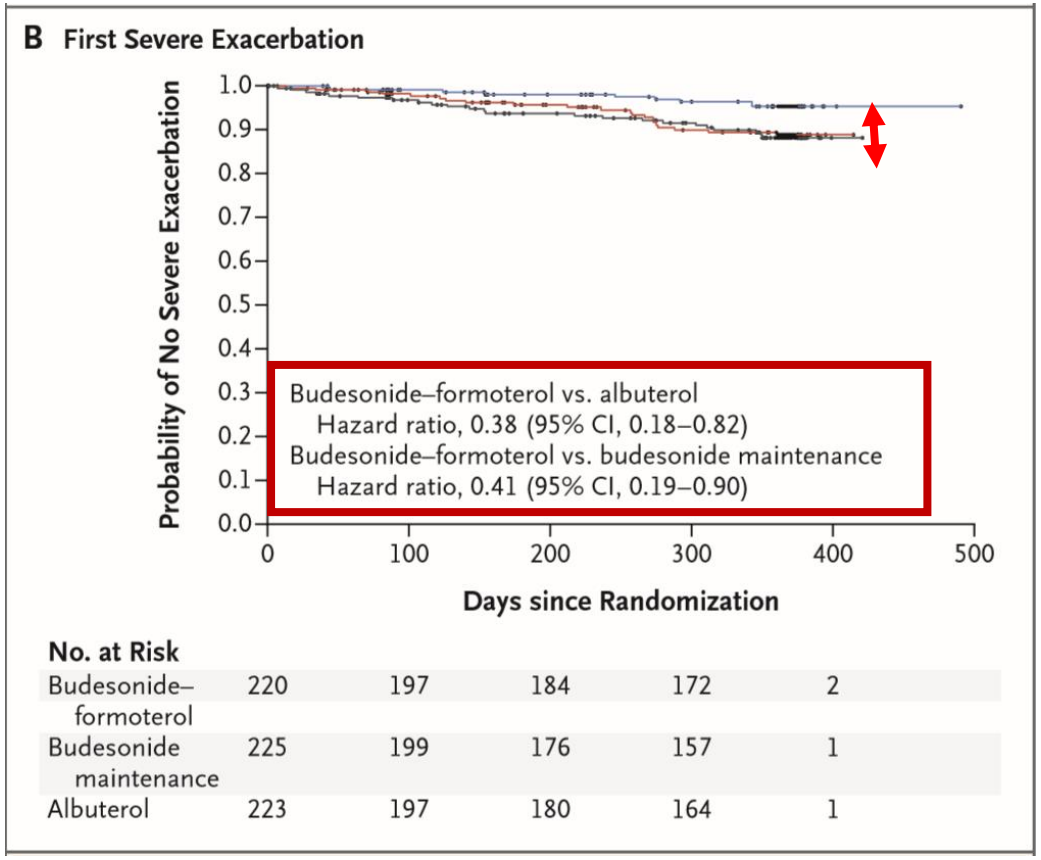
② Budesonide-formoterl as needed

③ Budesonide daily
+ albuterol as needed

Beasley et al.
N Engl J Med
2019;380(21):2020-2030

"Budesonide-formoterol as needed >> budesonide maintenance ≒ terbutaline as needed"





Beasley et al.
N Engl J Med
2019;380(21):2020-2030

1. Self-management of exacerbation

2) Combination low dose ICS with formoterol maintenance and reliever regimen

- **ICS (budesonide or beclometasone)-LABA (formoterol) 사용하는 GINA step 3-5 천식 환자**

→ controller 이면서 reliever로 single inhaler 를 사용

"Single Maintenance and Reliever Therapy (SMART)"

→ 증상 조절에 유리, 악화율 감소, 입원율 감소

*** Slower-onset LABA가 포함된 다른 ICS-LABA 제재는*

효과/안전성 면에서 증거가 부족하므로 시도하지 말 것!

Articles

Effect of budesonide in combination with formoterol for reliever therapy in asthma exacerbations: a randomised controlled, double-blind study

Klaus F Rabe, Tito Atienza, Pál Magyar, Per Larsson, Carin Jorup, Umesh G Lalloo

Subjects

3394 asthma

Symptomatic on **budesonide-formoterol** (160 ug/4.5ug)

Design

① Terbutaline as-needed

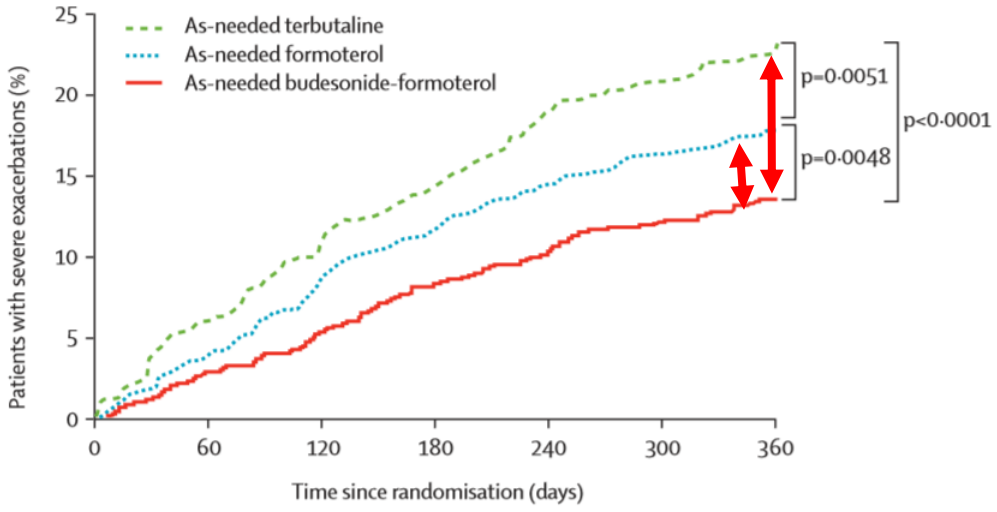
② Formoterol as-needed

③ Budesonide-formoterol as needed

Rabe et al. Lancet. 2006;368;744-53

"Budesonide-formoterol >> formoterol >> terbutaline"

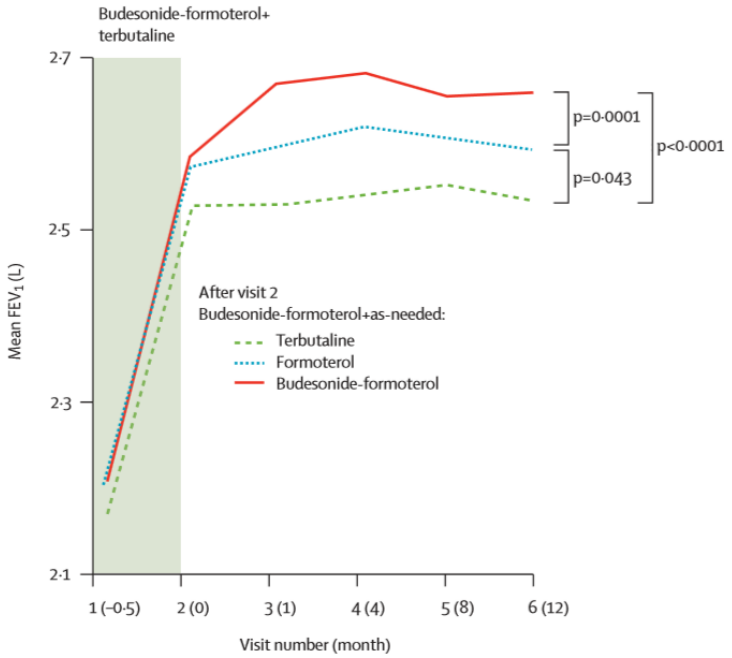
[Exacerbation]



Numbers at risk

Terbutaline	1138	1028	958	901	846	814	729
Formoterol	1137	1050	995	944	904	872	767
Budesonide-formoterol	1107	1036	994	941	912	886	795

[FEV_1]



Rabe et al. Lancet. 2006;368;744-53

Efficacy and safety of maintenance and reliever combination budesonide–formoterol inhaler in patients with asthma at risk of severe exacerbations: a randomised controlled trial

Mitesh Patel, Janine Pilcher, Alison Pritchard, Kyle Perrin, Justin Travers, Dominick Shaw, Shaun Holt, Matire Harwood, Peter Black†, Mark Weatherall, Richard Beasley, for the SMART Study Group

Subjects

303 asthma

Recent asthma exacerbation

Budesonide-formoterol

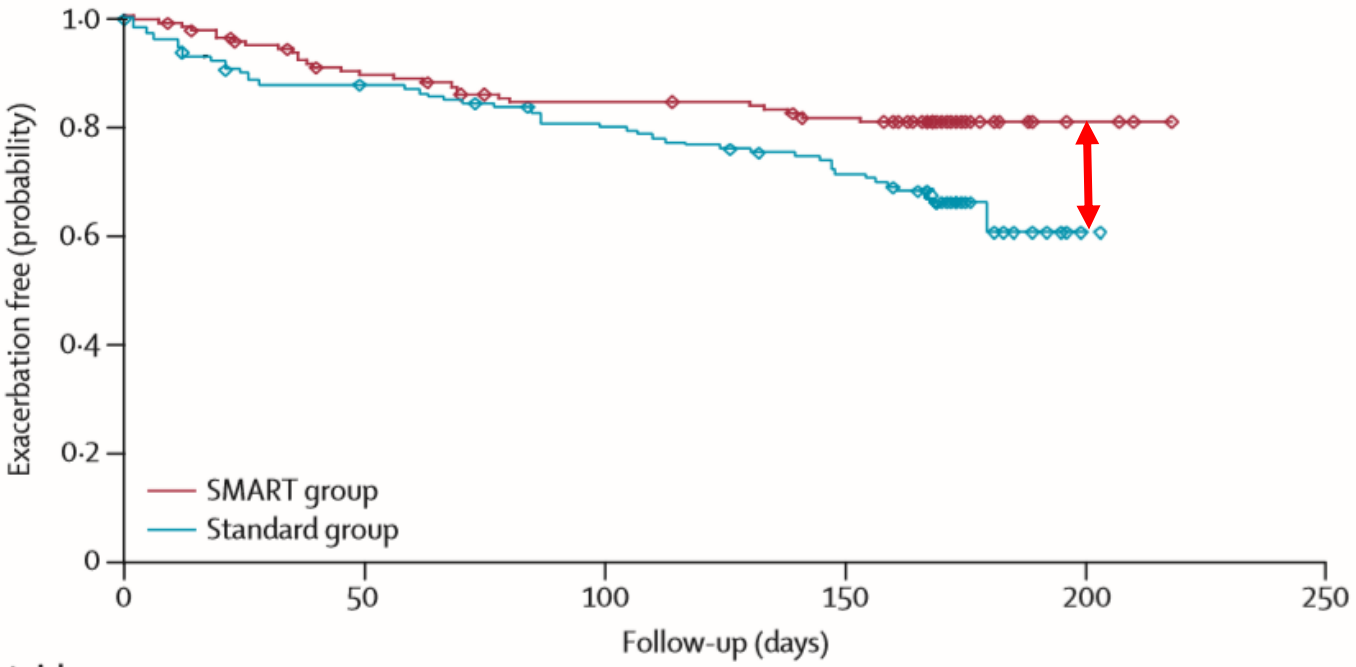
Design

① Terbutaline as-needed

② Budesonide-formoterol as needed

Papi et al.
Lancet Respir Med.
2013;1:32-42

"Budesonide-formoterol >> terbutaline"



Number at risk

SMART group	151	129	119	111
Standard group	152	128	115	101

Papi et al.
Lancet Respir Med.
2013;1:32-42

Beclometasone–formoterol as maintenance and reliever treatment in patients with asthma: a double-blind, randomised controlled trial

Alberto Papi, Massimo Corradi*, Catherine Pigeon-Francisco, Roberta Baronio, Zenon Siergiejko, Stefano Petruzzelli, Leonardo M Fabbri†, Klaus F Rabe†*

Subjects

1714 asthma (FEV_1>60%)

Recent asthma exacerbation (<12 m)

Beclomethasone-formoterol

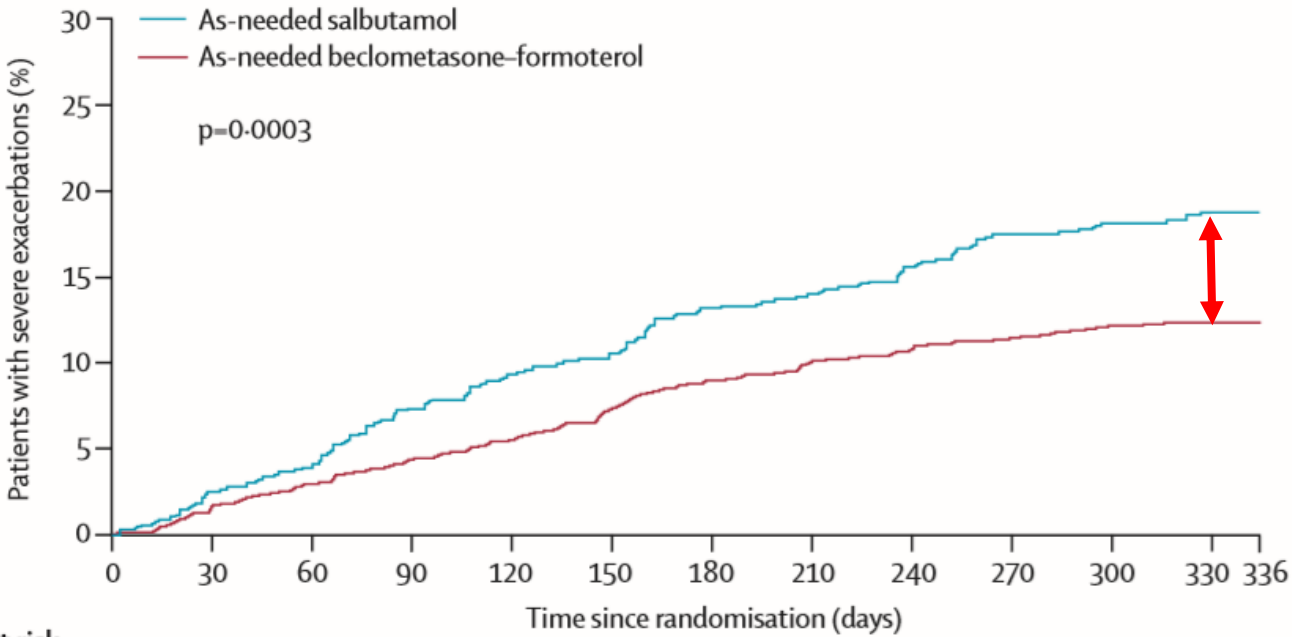
Design

① Terbutaline as-needed

② Beclomethasone-formoterl as needed

Papi et al.
Lancet Respir Med.
2013;1:23-31

"Beclometasone-formoterol >> salbutamol"



Number at risk												
Beclometasone–formoterol	852	822	800	779	761	743	719	704	696	681	673	658
Salbutamol	849	813	792	753	732	719	686	677	660	636	627	596

Papi et al.
Lancet Respir Med.
2013;1:23-31

Research

JAMA | Original Investigation

Association of Inhaled Corticosteroids and Long-Acting β-Agonists as Controller and Quick Relief Therapy With Exacerbations and Symptom Control in Persistent Asthma
A Systematic Review and Meta-analysis

Diana M. Sobieraj, PharmD; Erin R. Weeda, PharmD; Elaine Nguyen, PharmD, MPH; Craig I. Coleman, PharmD; C. Michael White, PharmD; Stephen C. Lazarus, MD; Kathryn V. Blake, PharmD; Jason E. Lang, MD, MPH; William L. Baker, PharmD

악화율

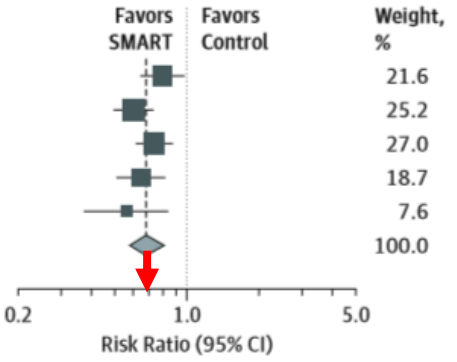
RR 0.68

(0.58-0.80)

Source	SMART Group: Total No. of Participants	SMART Group: No. With Event	Control Group: Total No. of Participants	Control Group: No. With Event	Absolute Risk Difference (95% CI), %	Risk Ratio (95% CI)
Vogelmeier et al,[23] 2012	1067	132	1076	167	-3.1 (-6.1 to -0.2)	0.80 (0.64 to 0.99)
Rabe et al,[25] 2006	1107	143	1138	245	-8.6 (-11.7 to -5.5)	0.60 (0.50 to 0.72)
Atienza et al,[24] 2013	1049	170	1042	229	-5.8 (-9.1 to -2.4)	0.74 (0.62 to 0.88)
Papi et al,[26] 2013	852	99	849	152	-6.3 (-9.6 to -2.9)	0.65 (0.51 to 0.82)
Patel et al,[27] 2013	151	28	152	50	-14.4 (-24.1 to -4.6)	0.56 (0.38 to 0.84)
Overall (random-effects model)	4226	572	4257	843	-6.4 (-10.2 to -2.6)	0.68 (0.58 to 0.80)

Heterogeneity: $I^2 = 29\%$, $P = .23$

Test for overall effect: $t_4 = -6.44$, $P < .001$



Sobieraj et al. JAMA. 2018;319(14):1485-1496

125/5 (14회)
250/10 (7회)

100/6 (4-12회)

"Formoterol 72 mcg"

160/4.5 (16회) 320/9 (8회)

1. Self-management of exacerbation

3) Other ICS and ICS-LABA maintenance controller regimens

- **Maintenance ICS with SABA as reliever**

  → **ICS dose 4배 증량**

- **Maintenance ICS-formoterol with SABA as reliever**

  → ICS-formoterol 4배 증량 (formoterol 최대 용량 72 mcg/day)

- **Maintenance ICS-other LABA with SABA as reliever**

  → ICS-other LABA 증량하거나, **ICS dose 4배 증량** 위해 ICS 추가

Quadrupling the Dose of Inhaled Corticosteroid to Prevent Asthma Exacerbations

A Randomized, Double-blind, Placebo-controlled, Parallel-Group Clinical Trial

Janet Oborne [1], Kevin Mortimer [1], Richard B. Hubbard [2], Anne E. Tattersfield [1], and Tim W. Harrison [1]

[1]Division of Respiratory Medicine and [2]Division of Epidemiology and Public Health, Respiratory Biomedical Research Unit, University of Nottingham, Nottingham, United Kingdom

Subjects

403 asthma

ICS maintenance

Design

① placebo

② **ICS dose-up (x4)**

Oborne et al.
Am J Respir Crit Care Med
2009;180(7):598-602

경구 **스테로이드 필요**한 경우

RR 0.43

(0.24-0.78)

TABLE 2. PRIMARY AND SECONDARY OUTCOMES

	Active	Placebo	Risk Ratio (95% CI)	P Value
Number randomized	197	206		
Number requiring oral corticosteroids	18	29	0.64 (0.37 to 1.11)	0.11
Number who started the study inhaler	56	38		
Number requiring oral corticosteroids	12	19	0.43 (0.24 to 0.78)	0.004

Definition of abbreviation: CI 5 confidence interval.

Oborne et al.
Am J Respir Crit Care Med
2009;180(7):598-602

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Quadrupling Inhaled Glucocorticoid Dose to Abort Asthma Exacerbations

Tricia McKeever, Ph.D., Kevin Mortimer, Ph.D., Andrew Wilson, M.D., Samantha Walker, Ph.D., Christopher Brightling, Ph.D., Andrew Skeggs, B.Sc., Ian Pavord, F.Med.Sci., David Price, F.R.C.G.P., Lelia Duley, M.D., Mike Thomas, Ph.D., Lucy Bradshaw, M.Sc., Bernard Higgins, Ph.D., Rebecca Haydock, B.Sc., Eleanor Mitchell, B.A., Graham Devereux, Ph.D., and Timothy Harrison, M.D.

Subjects

1922 asthma

ICS maintenance (+/- LABA)

At least one exacerbation in the previous 12 months

Design

① ICS maintenance

② **ICS dose-up (x4)**

McKeever et al. N Engl J Med 2018;378;902-910

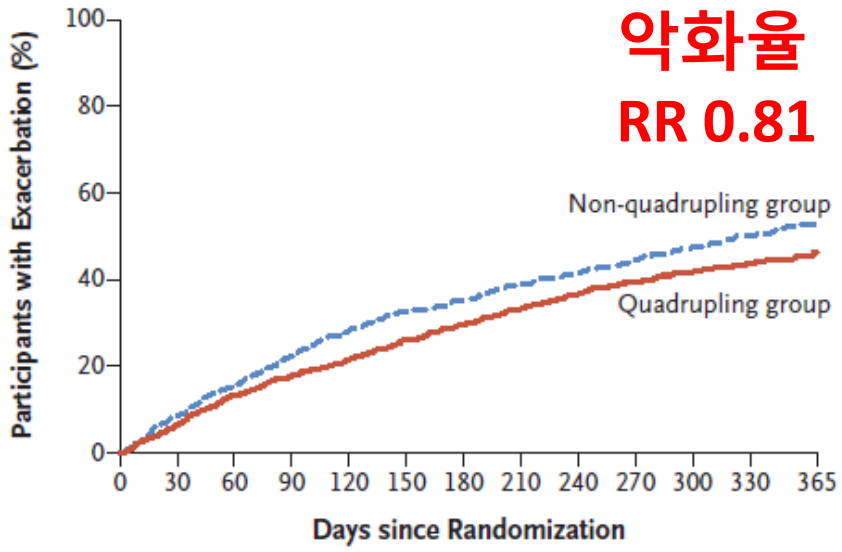
ICS maintenance user (about **30%**)
ICS-LABA combination user (about **70%**)

Type of inhaler — no. (%)		
Glucocorticoid	303 (31)	275 (29)
Combination	662 (69)	682 (71)

Table 1. Zone 2 of Asthma Self-Management Plans Used by the Two Groups.

Quadrupling Group	Non-Quadrupling Group
Indication of deteriorating asthma control (one or more)	**Indication of deteriorating asthma control (one or more)**
You need your reliever inhaler more than usual.	Your need your reliever inhaler more than usual.
You have more difficulty sleeping because of your asthma.	You have more difficulty sleeping because of your asthma.
Your peak flow is below [80% of your normal level].	Your peak flow is below [80% of your normal level].
Action	**Action**
Use your reliever inhaler to relieve your symptoms and quadruple your inhaled glucocorticoid dose as described.	Use your reliever inhaler to relieve your symptoms and continue your inhaled glucocorticoid medication at your normal dose.
Once your symptoms or peak flow have returned to normal or after a maximum of 14 days, return to your normal treatment.	
If your symptoms get worse, follow Zone 3 instructions.	If your symptoms get worse, follow Zone 3 instructions.
Start to record your morning peak flow, symptoms, and medication in the trial diary.	Start to record your morning peak flow, symptoms, and medication in the trial diary.
Telephone your research nurse to arrange a trial visit.	Telephone your research nurse to arrange a trial visit.

McKeever et al.
N Engl J Med
2018;378;902-910



No. at Risk							
Non-quadrupling group	938	791	671	592	521	463	349
Quadrupling group	933	806	727	644	558	508	366

Figure 2. Kaplan–Meier Curves for the Time to the First Severe Asthma Exacerbation, According to Assigned Group.

McKeever et al.
N Engl J Med
2018;378;902-910

1. Self-management of exacerbation

4) Oral corticosteroids

- **Short course of OCS (40-50 mg/day for 5-7 days)**

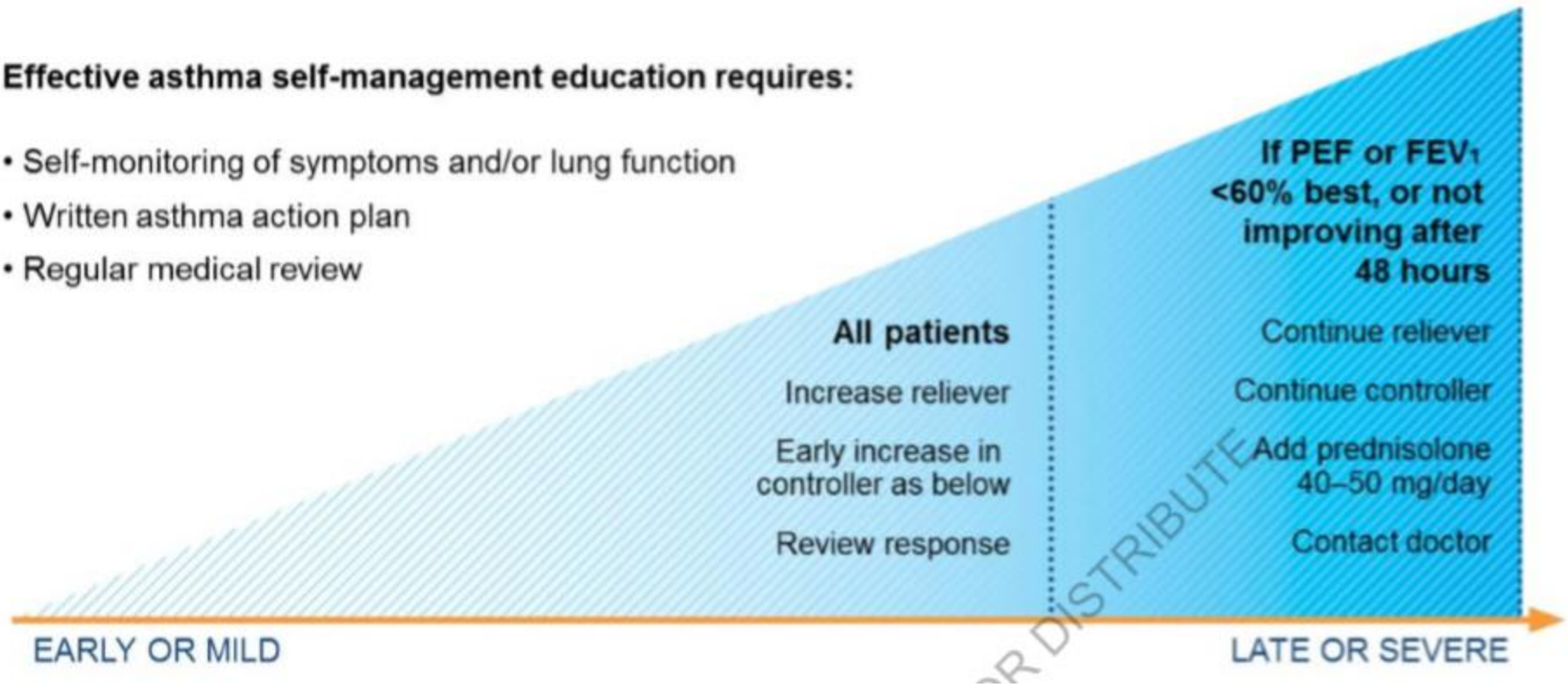
① Reliever와 controller medication을 2-3일간 증량에 실패

② 급작스러운 악화 또는 PEF or FEV_1이 최대치/예측치의 60% 미만

③ 갑작스러운 중증 악화 과거력 있는 경우

Effective asthma self-management education requires:

- Self-monitoring of symptoms and/or lung function
- Written asthma action plan
- Regular medical review



Medication	Short-term change (1–2 weeks) for worsening asthma	Evidence level
Increase usual reliever:		
Low-dose ICS/formoterol*	Increase frequency of reliever use (maximum formoterol total 72 mcg/day)	A
Short-acting beta$_2$-agonist (SABA)	Increase frequency of SABA use For pMDI, add spacer	A A
Increase usual controller:		
Maintenance and reliever ICS/formoterol *	Continue maintenance ICS/formoterol and increase reliever ICS/formoterol as needed* (maximum formoterol total 72 mcg/day)	A
Maintenance ICS with SABA as reliever	In adults and adolescents, quadruple ICS dose. In children with high adherence, 5x increase in ICS dose is not effective	B
Maintenance ICS/formoterol with SABA as reliever	Quadruple maintenance ICS/formoterol (maximum formoterol 72 mcg/day)	B
Maintenance ICS/other LABA with SABA as reliever	Step up to higher dose formulation of ICS/other LABA, or consider adding a separate ICS inhaler to quadruple ICS dose	D
Add oral corticosteroids (OCS) and contact doctor; review before ceasing		
OCS (prednisone or prednisolone)	Add OCS for severe exacerbations (e.g. PEF or FEV$_1$ <60% personal best or predicted), or patient not responding to treatment over 48 hours. Once started, morning dosing is preferable.	A
	Adults: prednisolone 40-50mg/day, usually for 5–7 days. *Children 6-11 yrs*: 1–2 mg/kg/day (maximum 40 mg) usually for 3–5 days.	D
	Tapering is not needed if OCS are prescribed for <2 weeks	B

2. Management in primary care

2. Management in primary care

1) Assessement

Mild/moderate	Severe	Life-threatening
• '구'단위 대화 • 앉거나 누워있음 • PR 100-120 bpm • SatO2, 90-95% • PEFpred > 50%	• 단어로 대화 • 수그리고 앉음 • 불안 • PR >120 bpm • satO2, <90% • PEFpred<50%	• Drowsy • Confused • Silent chest

2. Management in primary care

2) Start management

Mild/moderate	Severe, life-threatening
• SABA 4-10 puffs by pMDI + spacer, repeat every 20 min for 1 hours • Prednisolone: 40-50 mg • O2 (target: 93-95%)	• 응급실 이송 • 기다리는 동안, SABA, **ipratropium,** O2, systemic corticosteroid

악화시

2. Management in primary care

2) Start management

- **Inhaled SABA**

SABA 반복 흡입 (up to 4-10 puffs every 20 min, for 1 h)

→ 1 시간 뒤, SABA 반복 흡입 (up to 6-10 puffs every 1-2 h)

→ PEF > 60-80% 가 3-4 h 지속시, SABA 중지

"**Nebulizer** vs. **pMDI with spacer** vs. **DPI**"

2. Management in primary care

2) Start management

- **Controlled oxygen therapy**

: SatO2 목표 93-95% 유지

(100%로 유지하는 것보다 나은 결과 보임)

Randomised controlled trial of high concentration versus titrated oxygen therapy in severe exacerbations of asthma

Kyle Perrin,[1,2] Meme Wijesinghe,[1,2] Bridget Healy,[1,2] Kirsten Wadsworth,[1] Richard Bowditch,[1,2] Susan Bibby,[1,2] Tanya Baker,[1] Mark Weatherall,[2,3] Richard Beasley[1,2,3]

Subjects

106 asthma

Severe exacerbation (**ER**)

Design

① O2 8 L/min via mask

② titrated oxygen
(93-95% target)

Perrin et al. Thorax 2011;66:937-941

Table 2 The proportion of patients with a predetermined rise in the transcutaneous partial pressure of carbon dioxide ($Ptco_2$) from baseline at 60 min

	High concentration O_2 n (%)	Titrated O_2 n (%)	RR (95% CI)	p Value
Change in $Ptco_2$ ≥4 mm Hg	22 (44%)	10 (19%)	2.3 (1.2 to 4.4)	0.006
Change in $Ptco_2$ ≥4 mm Hg and $Ptco_2$ ≥38 mm Hg	17 (34%)	4 (8%)	4.5 (1.6 to 12.5)	0.001
Change in $Ptco_2$ ≥8 mm Hg	11 (22%)	3 (6%)	3.9 (1.2 to 13.1)	0.016

PtCO2 상승률
RR 2.3-4.5

Table 4 Risk of hospital admission

	OR (95% CI)	p Value
(1) Unadjusted analysis		
High concentration oxygen*	2.29 (1.03 to 5.10)	0.042
(2) Adjusted analysis		
High concentration oxygen	1.70 (0.68 to 4.26)	0.257
Baseline oxygen saturation (per %)	0.80 (0.66 to 0.98)	0.028
Baseline $Ptco_2$ (per mm Hg)	1.04 (0.96 to 1.12)	0.370
Baseline FEV_1 (per litre)	0.31 (0.10 to 0.94)	0.039

*High concentration oxygen versus titrated oxygen.
FEV_1, forced expiratory volume in 1 s; $Ptco_2$, transcutaneous partial pressure of carbon dioxide.

입원률
RR 1.70-2.29

Perrin et al. Thorax 2011;66:937-941

2. Management in primary care

2) Start management

- **Systemic corticosteroids**

: OCS는 즉각적으로 투여 해야 함

: 1 mg prednisolone/kg/day (최대 50 mg/day)

: 통상 5-7일간 유지

: 불면, 식욕 증가, 역류, 기분 변화에 대한 부작용 설명 필요

2. Management in primary care

2) Start management

- **Controller medication**

사용 중이던 controller를 향후 2-4주간 증량

사용 중이던 controller가 없다면, 규칙적인 ICS 포함 흡입기 처방

2. Management in primary care

2) Start management

- **Antibiotics (not recommended)**

감염의 증거 (발열, 누런 가래, 폐렴 등)가 명확하지 않는 한,
항생제의 역할은 없음.

항생제 사용 전에, 고용량의 ICS를 강력하게 사용해야 함

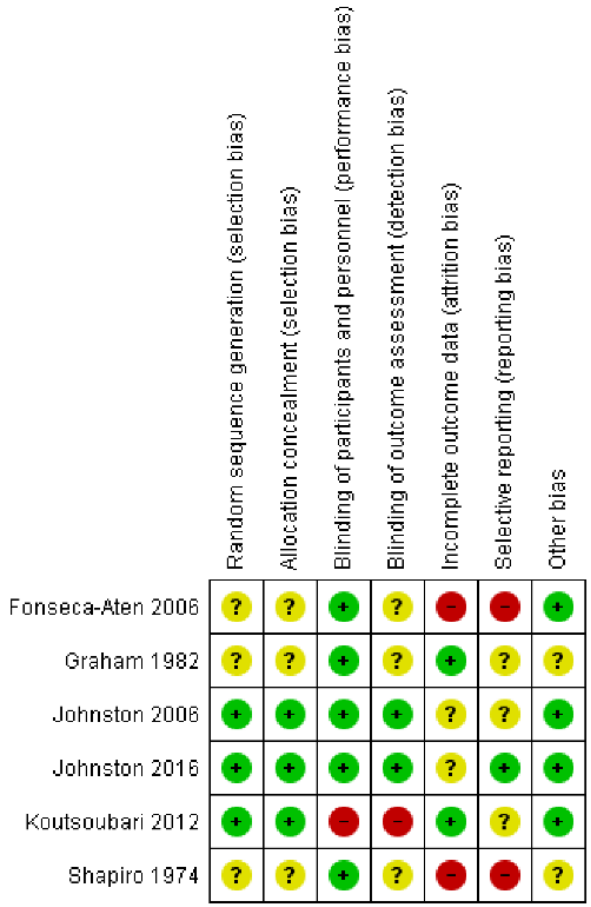
Cochrane Library

Cochrane Database of Systematic Reviews

6개 study

Antibiotics for exacerbations of asthma (Review)

Normansell R, Sayer B, Waterson S, Dennett EJ, Del Forno M, Dunleavy A

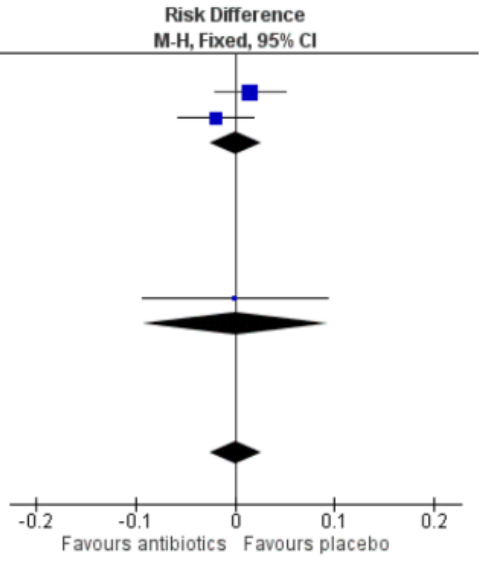


Normansell et al. Cochrane Database Syst Rev. 2018;25;6:CD002741

Serious adverse event
(사망, life-threatening event, 입원 등)
Risk difference 0.00 (-0.03-0.03)

Figure 1. Forest plot of comparison: 1 Antibiotics versus placebo/usual care, outcome: 1.3 Serious adverse events.

Study or Subgroup	Antibiotics Events	Antibiotics Total	Placebo/usual care Events	Placebo/usual care Total	Weight	Risk Difference M-H, Fixed, 95% CI
1.3.1 Adults						
Johnston 2006	4	131	2	132	52.4%	0.0154 [-0.0207, 0.0515]
Johnston 2016 (1)	1	97	3	102	39.7%	-0.0191 [-0.0576, 0.0194]
Subtotal (95% CI)		**228**		**234**	**92.1%**	**0.0005 [-0.0259, 0.0269]**
Total events	5		5			
Heterogeneity: Chi² = 1.65, df = 1 (P = 0.20); I² = 39%						
Test for overall effect: Z = 0.04 (P = 0.97)						
1.3.2 Children						
Koutsoubari 2012 (2)	0	18	0	22	7.9%	0.0000 [-0.0934, 0.0934]
Subtotal (95% CI)		**18**		**22**	**7.9%**	**0.0000 [-0.0934, 0.0934]**
Total events	0		0			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.00 (P = 1.00)						
Total (95% CI)		**246**		**256**	**100.0%**	**0.0005 [-0.0250, 0.0260]**
Total events	5		5			
Heterogeneity: Chi² = 1.65, df = 2 (P = 0.44); I² = 0%						
Test for overall effect: Z = 0.04 (P = 0.97)						
Test for subgroup differences: Chi² = 0.00, df = 1 (P = 0.99), I² = 0%						



Footnotes
(1) Total N unclear, assumed total randomised
(2) Defined as no child needing hospitatilisation

Normansell et al. Cochrane Database Syst Rev. 2018;25;6:CD002741

2. Management in primary care

3) Discharge

- **Assess for discharge (after 1 hour)**

SABA 불필요할 정도로 증상 호전, PEFpred >60-80%, O2 > 94% at RA

- **Arrange at discharge**

Reliever: 필요시 사용

Controller: 시작/증량. 흡입기 사용 테크닉 및 adherence 체크

Prednisolone: continue, usually for 5-7 days

Follow-up: within 2-7 days

2. Management in primary care

4) Follow-up

- **Review symptoms and signs:** 호전 여부/prednisone 유지 여부
- **Reliever:** as-needed로 사용
- **Controller:** 1-2주 (또는 3개월) 증량 → 2-4주 뒤 감량 다시 가능
- **Risk factors:** 흡입기 사용 테크닉, adherence 체크
- **Action plan 수정**

3. Management in emergency department

3. Management in emergency dep.

1) Assessment

- **Initial assessment**

  : A (airway), B (breathing), C (circulation)

- **Are any of the following present?**

  : Drowsiness, Confusion, Silent chest

  → Consult ICU, start SABA, O2, and prepare intubation

3. Management in emergency dep.

1) Assessment

- **Measurement of lung function (PEF or FEV_1)**

: 강력히 권고됨 (가능하다면 시작 전 확인 필요)

→ 1시간 간격으로 추적 검사 필요

- **Oxygen saturation**

: Oximetry로 지속 관찰 필요

→ oxygen 공급 전, 도는 중단 후 5분 뒤 측정 필요

3. Management in emergency dep.

1) Assessment

- **Arterial blood gas measurement (ABG):** 루틴 아님

→ PEF/FEV_1 <50% 또는 치료에 반응 없을시 시행

→ 피로/졸림 등은 pCO2 상승 시사

→ PaO2<60 mmHg, PaCO2 >45 mmHg는 호흡곤란을 의미

- **Chest X-ray (CXR):** 루틴 아님

→ Cardiopulmonary process, pneumothorax, fever, foreign body, lung parenchymal disease 의심시 시행

3. Management in emergency dep.

2) TRIAGE & treatment

"Mild to moderate"

- **Assessment**

Talks in phrases

Prefers sitting to lying

Not agitated

Respiratory rate increased

Accessory muscle not used

PR 100-120 bpm

O2 sat 90-95% at RA

PEFpred > 50%

- **Treatment**

SABA

Consider ipratropium bromide

Controlled O2 (93-95%)

Oral corticosteroids

3. Management in emergency dep.

2) TRIAGE & treatment

"Severe"

- **Assessment**

Talks in words

Sits hunched forwards

Agitated

RR > 30/min

Accessory muscle used

PR >120 bpm

O2 sat < 90% at RA

PEFpred < 50%

- **Treatment**

SABA

Ipratropium bromide

Controlled O2 (93-95%)

Oral or **IV** corticosteroids

Consider IV magnesium

Consider high dose ICS

3. Management in emergency dep.

2) TRIAGE & treatment

- **Epinephrine (for anaphylaxis)**

: Anaphylaxis/혈관부종과 동반된 경우, 근주

: Routine 한 급성 천식 악화 치료는 아님

3. Management in emergency dep.

2) TRIAGE & treatment

- **Systemic corticosteroid**

① 초기 SABA 사용으로 증상 호전 없는 경우

② 이미 OCS 복용 중 발생한 급성 천식 악화

③ 이전에 OCS 투여가 필요한 급성 악화 병력이 있는 경우

→ **Route:** Oral ≒ IV

→ **Dosage:** 50 mg prednisolone as a single morning dose, or 200 mg hydrocortisone in divided doses

→ **Duration:** 5-7 days (≒ 10-14 days)

** **Dexamethasone for 1-2 days:** 경구 투여 어려운 경우 대체 가능

Corticosteroid Use after Hospital Discharge among High-risk Adults with Asthma

Jerry A. Krishnan, Kristin A. Riekert, Jonathan V. McCoy, Dana Y. Stewart, Spencer Schmidt, Arjun Chanmugam, Peter Hill, and Cynthia S. Rand

Departments of Medicine and Emergency Medicine, Johns Hopkins University, Baltimore, Maryland; Department of Emergency Medicine, University of Pennsylvania, Philadelphia, Pennsylvania; and Department of Pediatrics, Wright State University, Dayton, Ohio

Subjects

60 severe asthma attack

Prospective cohort study

Design

Observation for **compliance**

① ICS use

② OCS use

Krishnan et al.
Am J Respir Crit Care Med
2004;170 (12):1281-1285

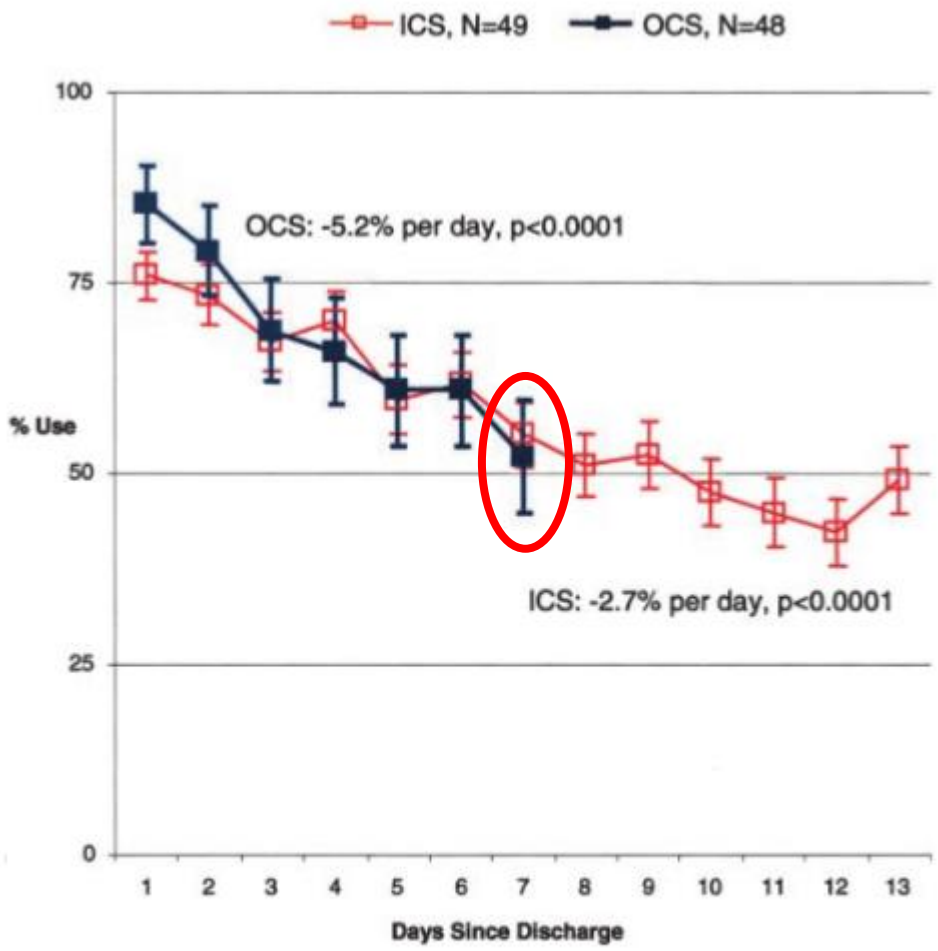


Figure 1. Corticosteroid use after hospital discharge home. Electronically measured use (percentage prescribed dose; error bars represent SE) of inhaled corticosteroids (ICS) and oral corticosteroids (OCS) after hospital discharge. Use was measured using electronic medication monitors.

퇴원 7일 뒤,
Compliance of
ICS/OCS use
: 50%

Krishnan et al.
Am J Respir Crit Care Med
2004;170 (12):1281-1285

A single dose of intramuscularly administered dexamethasone acetate is as effective as oral prednisone to treat asthma exacerbations in young children

Delores M. Gries, MD, Donald R. Moffitt, MD, Elizabeth Pulos, PhD, and Edward R. Carter, MD

Subjects

32 children with mild-moderate asthma attack requiring OCS

Design

① **IM dexamethasone (-1.7 mg/kg)**

② OCS for 5 days (-2 mg/kg/d)

Gries et al. J Pediatr 2000;136:298-303

"Dexa IM single dose ≒ oral prednisone"

Table IV. Outcome measures: Dexamethasone acetate versus prednisone

Outcome variable	IM Dex	Oral prednisone	*P* value
Patients with any personality changes within the first 5 days (%)	10/14 (71)	14/16 (87)	.38
Patients who "cleared" symptoms by day 5 (%)	11/15 (73)	11/17 (65)	.71
Patients who had a relapse within 1 month (%)	1/15 (7)	3/17 (18)	.60
Patients who required continuation of the steroid course (%)	1/15 (7)	1/17 (6)	>.99
Parents who preferred the "shot" (%)	10/14 (71)	11/16 (69)	>.99
No. of albuterol administrations on day 5	1.4 (1.3)	1.2 (1.5)	.67
Urine cortisol/creatinine (nmol/mmol)*	1.7 (0.23 – 21.0) [n = 13]	4.6 (0.96 – 32.6) [n = 8]	.10

*Values are expressed as median (range).

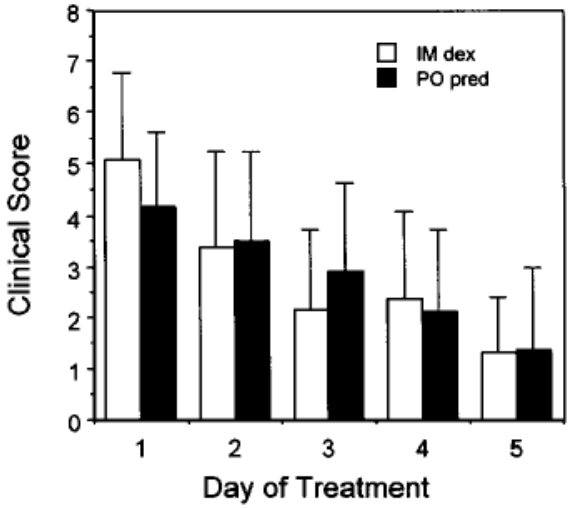


Figure. Clinical asthma score (0 = no problem, 8 = most severe). Both groups demonstrated clinical improvement during the first 5 days of treatment ($P < .0001$), and no significant difference was found in clinical asthma score between the 2 groups ($P = .98$). Values are expressed as mean ± SD.

Gries et al.
J Pediatr
2000;136:298-303

PEDIATRICS/ORIGINAL RESEARCH

A Randomized Trial of Single-Dose Oral Dexamethasone Versus Multidose Prednisolone for Acute Exacerbations of Asthma in Children Who Attend the Emergency Department

John J. Cronin, MB, AFRCSI; Siobhan McCoy, RGN, RCN; Una Kennedy, FRCEM; Sinéad Nic an Fhailí, PhD, MICR; Abel Wakai, MD, FRCEM; John Hayden, BPharm; Gloria Crispino, PhD, CStat; Michael J. Barrett, MB, MRCPI; Sean Walsh, FRCEM; Ronan O'Sullivan, FPAEDS, MBA*

*Corresponding Author. E-mail: ronanosullivan@ucc.ie, Twitter: @RonanOSull.

Subjects

245 children with asthma attack requiring admission to a tertiary pediatric ED

Design

① IM dexamethasone

② OCS for 3 days

Cronin et al.
Ann Emerg Med
2016;67:593-601.e3.

"Dexa IM single dose ≒ oral prednisone"

Table 3. Primary outcome (χ^2 test).

Day 4 PRAM Scores	DEX Mean (SD)	PRED Mean (SD)	Mean Difference (95% CI of Difference)
All patients	0.91 (1.16) n=120	0.91 (1.52) n=115	-0.005 (-0.35 to 0.34)
All patients excluding reenrollments	0.92 (1.15) n=110	0.92 (1.55) n=108	0 (-0.36 to 0.36)
Patients ≥6 y	1.00 (1.14) n=44	0.81 (1.58) n=43	0.19 (-0.40 to 0.77)
Patients 2-5 y	0.86 (1.16) n=66	0.98 (1.54) n=65	-0.12 (-0.59 to 0.35)
Male patients	0.94 (1.23) n=67	0.86 (1.31) n=83	0.085 (-0.328 to 0.498)
Female patients	0.88 (1.03) n=43	1.12 (2.186) n=25	-0.236 (-1.016 to 0.543)
Mild exacerbation*	1.00 (1.26) n=49	0.79 (1.23) n=43	0.209 (-0.307 to 0.725)
Moderate exacerbation*	0.81 (1.104) n=48	0.85 (1.615) n=55	-0.042 (-0.591 to 0.507)
Severe exacerbation*	1.00 (0.913) n=13	1.80 (2.201) n=10	-0.800 (-2.197 to 0.597)

*A mild exacerbation refers to a PRAM score between 1 and 3 at initial ED assessment; moderate, 4 and 7; and severe, 8 and 12.

Cronin et al.
Ann Emerg Med
2016;67:593-601.e3.

REVIEW ARTICLE

Dexamethasone for Acute Asthma Exacerbations in Children: A Meta-analysis

AUTHORS: Grant E. Keeney, MD,[a] Matthew P. Gray, MD,[a] Andrea K. Morrison, MD, MS,[a] Michael N. Levas, MD,[a] Elizabeth A. Kessler, MD, MS,[a] Garick D. Hill, MD, MS,[a] Marc H. Gorelick, MD, MSCE,[a] Jeffrey L. Jackson, MD, MPH[b,c]

Departments of [a]Pediatrics, and [b]General Internal Medicine, Medical College of Wisconsin, Milwaukee, Wisconsin; and [c]Zablocki VAMC, Milwaukee, Wisconsin

abstract

BACKGROUND AND OBJECTIVE: Dexamethasone has been proposed as an equivalent therapy to prednisone/prednisolone for acute asthma exacerbations in pediatric patients. Although multiple small trials exist, clear consensus data are lacking. This systematic review and

6개 study

TABLE 2 Cochrane Risk of Bias Quality Assessment

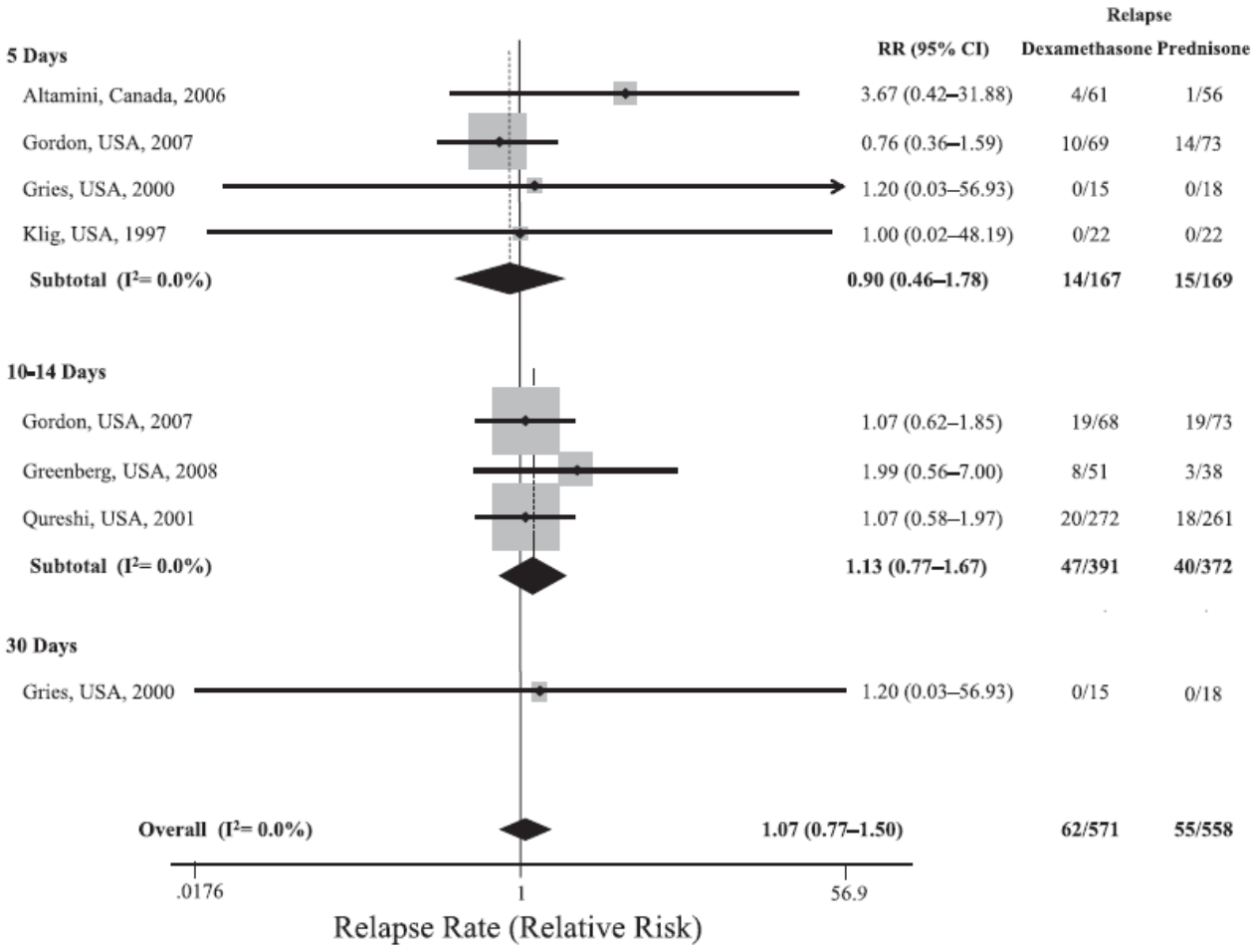
Study	Allocation Sequence Adequate	Allocation Concealed	Blinding of Participants	Blinding of Outcomes	Outcome Data Adequately Addressed	Free From Selective Outcome Reporting	Free From Other Problems
Altamimi[11]	Yes	Yes	Yes	Yes	No	Unclear	Yes
Gordon[12]	Yes	Yes	No	No	Yes	No	Yes[a]
Qureshi[16]	No	No	No	No	Yes	Unclear	Yes[a]
Greenberg[13]	Unclear[a]	Unclear[a]	Yes	Unclear	No	Unclear	Yes
Gries[14]	Unclear	Unclear	No	No	Yes[a]	Unclear	Yes
Klig[15]	Unclear	Unclear	No	No	Yes	Unclear	Yes

[a] Disagreement between reviewers.

Keeney et al. Pediatrics 2014;133:493-499

Asthma attack relapse

RR 0.90-1.20



Keeney et al. Pediatrics 2014;133:493-499

Vomiting in the ED
RR 0.29 (0.12-0.69)

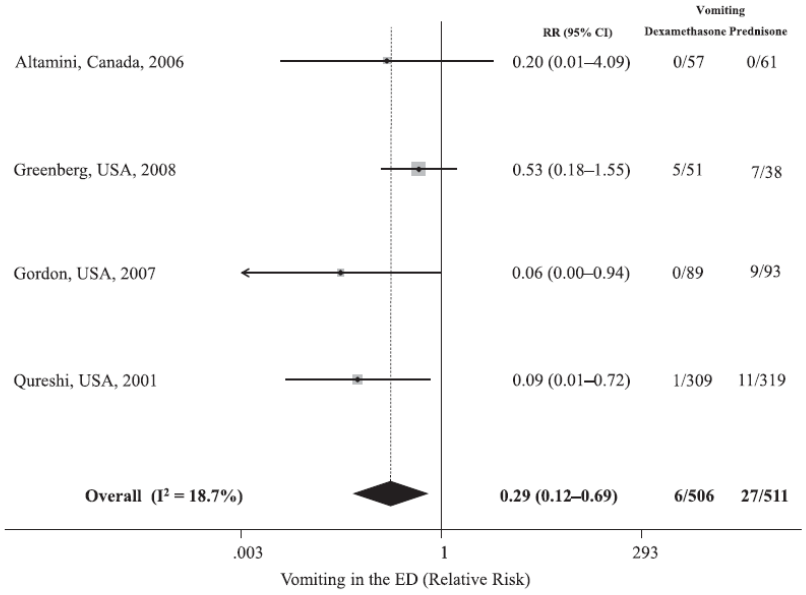


FIGURE 3
Vomiting in the ED.

Vomiting at home
RR 0.41 (0.17-0.99)

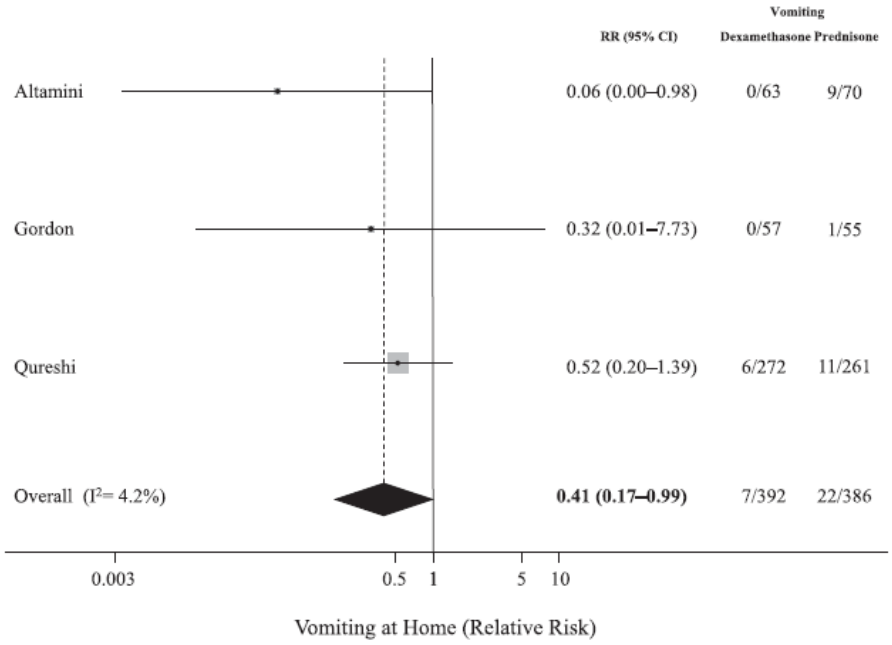


FIGURE 4
Vomiting at home.

Keeney et al.
Pediatrics
2014;133:493-499

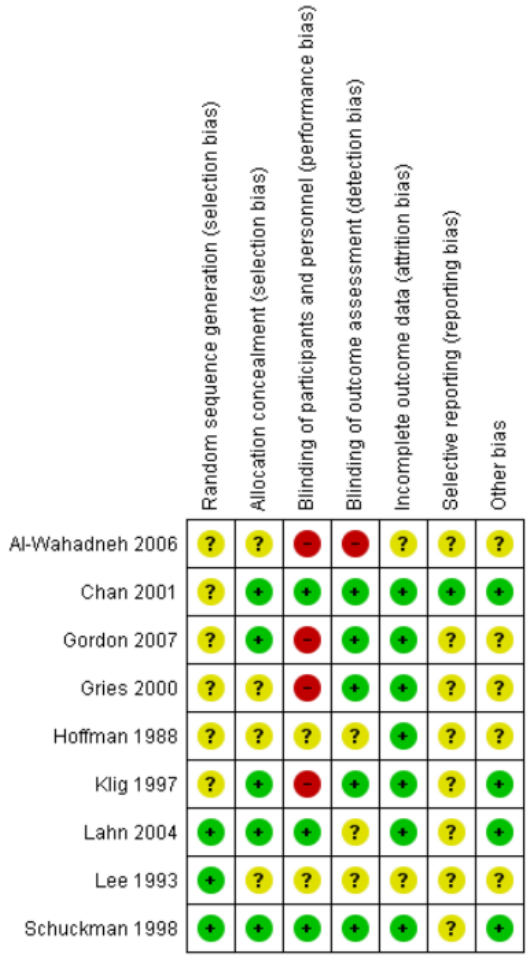
Cochrane Library

Cochrane Database of Systematic Reviews

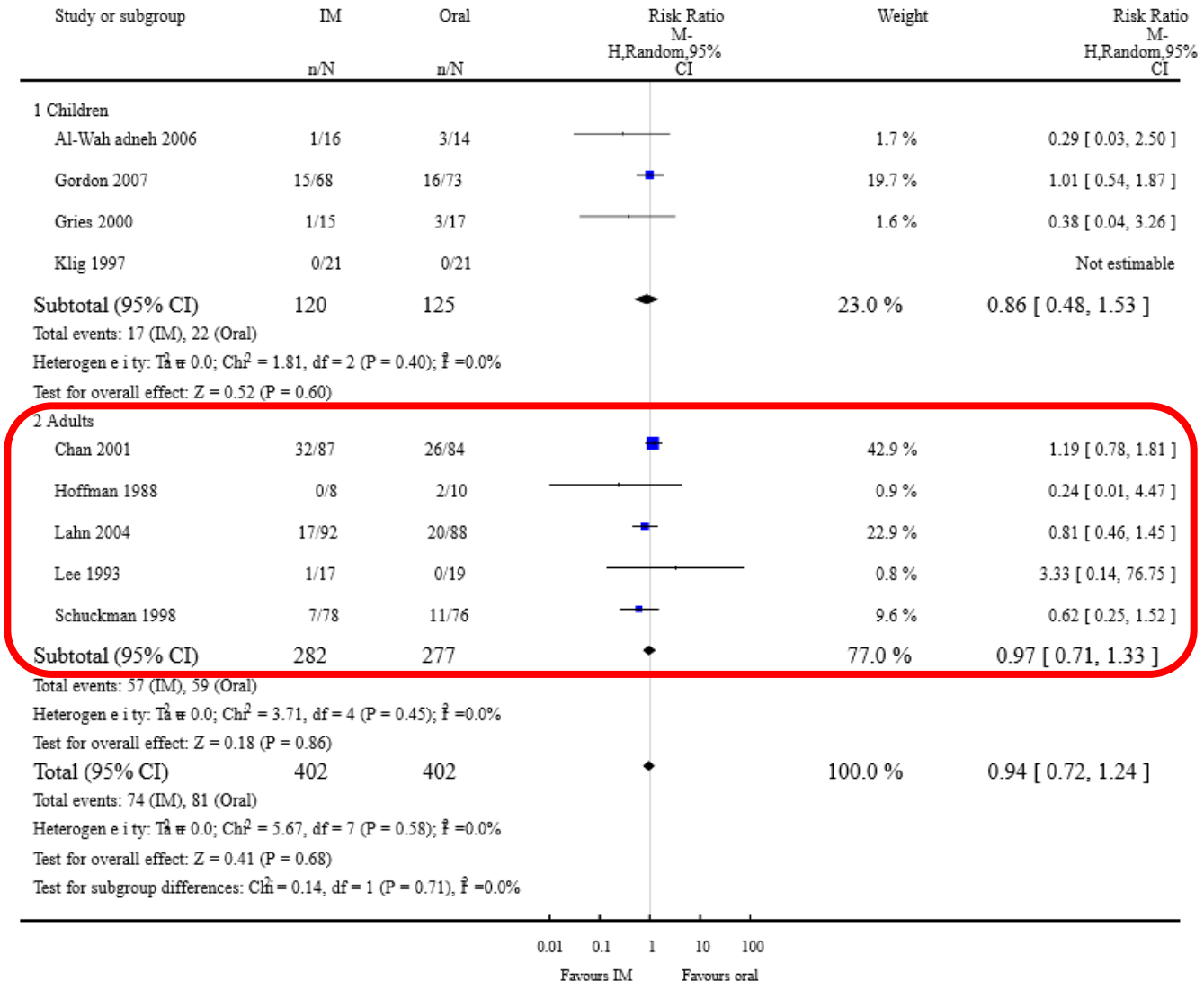
9개 study

Intramuscular versus oral corticosteroids to reduce relapses following discharge from the emergency department for acute asthma (Review)

Kirkland SW, Cross E, Campbell S, Villa-Roel C, Rowe BH



Kirkland et al.
Cochrane Database Syst Rev
2018;6:Cd012629



Asthma attack relapse
RR 0.97 (0.71-1.33)

Kirkland et al.
Cochrane Database Syst Rev
2018;6:Cd012629

Intramuscular corticosteroids compared to Oral corticosteroids for acute asthma

Patient or population: patients with acute asthma
Settings: Acute care settings
Intervention: Intramuscular corticosteroids
Comparison: Oral corticosteroids

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)
	Assumed risk	Corresponding risk			
	Oral corticosteroids	Intramuscular corticosteroids			
Relapse	201 per 1000	12 fewer per 1000 (from 56 fewer to 48 more)	RR 0.94 (0.72 to 1.24)	804 (9 studies)	⊕⊕ low[1,2]
Relapse within 10 days post-discharge	154 per 1000	40 fewer per 1000 (from 75 fewer to 11 more)	RR 0.74 (0.51 to 1.07)	742 (7 studies)	⊕⊕⊕ moderate[1]
Relapse occurring after 10 days post-discharge	245 per 1000	2 fewer per 1000 (from 64 fewer to 81 more)	RR 0.99 (0.74 to 1.33)	556 (5 studies)	⊕⊕ low[1,2]
Adverse events	294 per 1000	50 fewer per 1000 (from 106 fewer to 21 more)	RR 0.83 (0.64 to 1.07)	404 (5 studies)	⊕⊕ low[1,3]
Pulmonary function: Peak expiratory flow	The mean pulmonary function: peak expiratory flow ranged across control groups from 304 to 419 litres/min	The mean pulmonary function: peak expiratory flow in the intervention groups was 7.78 liters/min lower (38.83 lower to 23.28 higher)		272 (4 studies)	⊕⊕⊕ moderate[2]
Symptom persistence	537 per 1000	317 fewer per 1000 (from 461 fewer to 107 more)	RR 0.41 (0.14 to 1.2)	80 (3 studies)	⊕⊕ low[1,3]
24-hour beta agonist use	375 per 1000	172 fewer per 1000 (from 296 fewer to 139 more)	RR 0.54 (0.21 to 1.37)	48 (2 studies)	⊕⊕ low[1,3]

Kirkland et al.
Cochrane Database Syst Rev 2018;6:Cd012629

3. Management in emergency dep.

2) TRIAGE & treatment

- **ICS**

① 응급실에서

: 전신 스테로이드 투여 받지 않는 경우, 한 시간 내 ICS 고용량

: 전신 스테로이드 투여 받는 경우, ICS 역할은 불분명

② 퇴원시

: 반드시 규칙적인 ICS 사용이 필요함

3. Management in emergency dep.

2) TRIAGE & treatment

- **Ipratropium bromide**

: SABA와 병용시 입원률을 줄이고, 폐기능 호전 시켜주는 효과

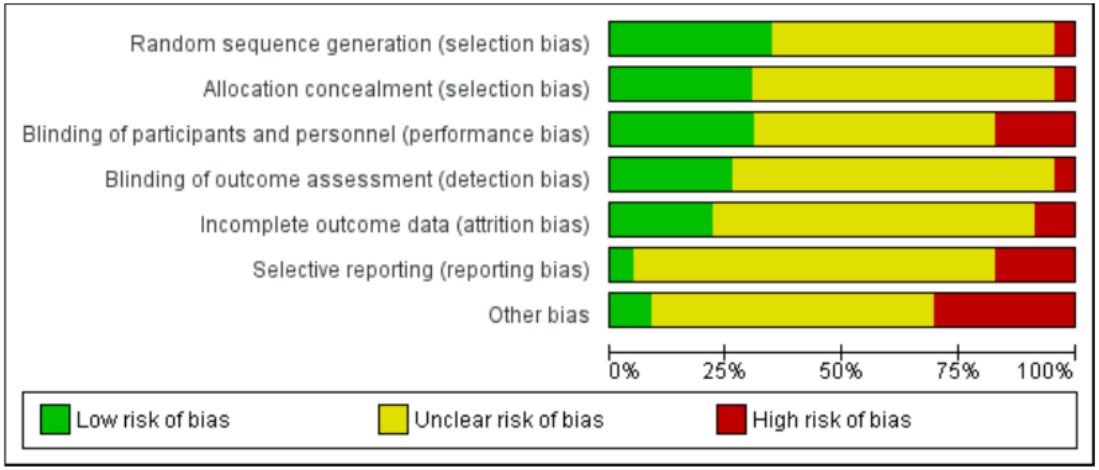
Cochrane Library

Cochrane Database of Systematic Reviews

Combined inhaled beta-agonist and anticholinergic agents for emergency management in adults with asthma (Review)

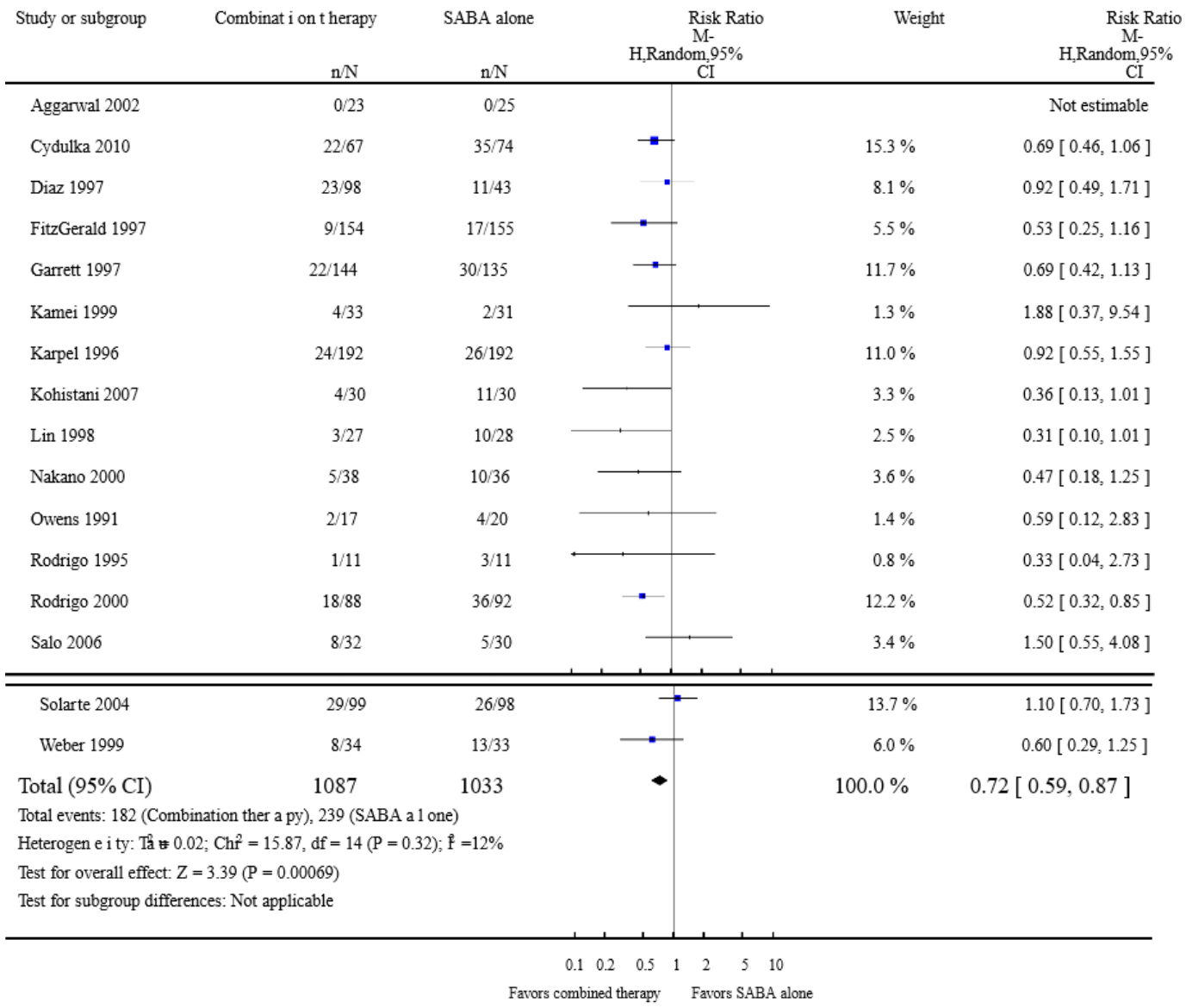
Kirkland SW, Vandenberghe C, Voaklander B, Nikel T, Campbell S, Rowe BH

Figure 4. Risk of bias gr aph



7개 study

Kirkland et al. Cochrane Database Syst Rev 2017;1:Cd001284

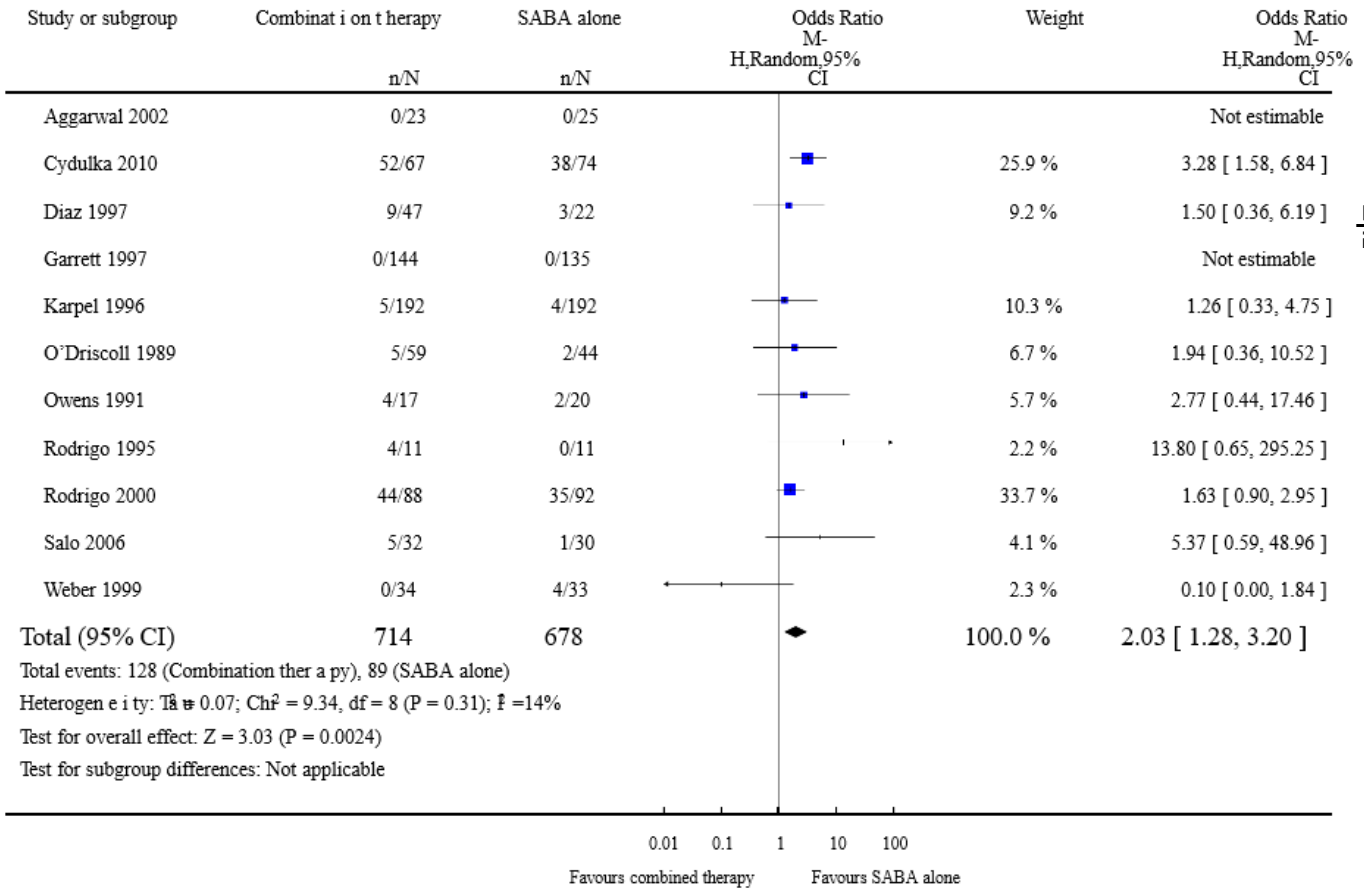


입원률

RR

0.72 (0.59-0.86)

Kirkland et al. Cochrane Database Syst Rev 2017;1:Cd001284



전체 부작용
(구강건조, 손떨림, 불안, 두근거림, 구역, 두통, 시야 흐림 등)
RR
2.03 (1.28-3.20)

Kirkland et al.
Cochrane Database Syst Rev
2017;1:Cd001284

3. Management in emergency dep.

2) TRIAGE & treatment

- **Aminophylline and theophylline**

: 효과가 미미하며 및 안전성에 대한 issue가 있어 사용하지 않음

- **Magnesium**

: Routine으로 사용해서는 안됨

: 다만, FEV_1pred <25-30% 이거나 초기 치료에도 저산소증이 지속되는, **중증 천식 악화**의 경우에는, 2 g Magneisum sulfate를 20분간 주입하는 것이 입원률 감소에 효과적

Intravenous or nebulised magnesium sulphate versus standard therapy for severe acute asthma (3Mg trial): a double-blind, randomised controlled trial

Steve Goodacre, Judith Cohen, Mike Bradburn, Alasdair Gray, Jonathan Benger, Timothy Coats, on behalf of the 3Mg Research Team*

Subjects

1109 asthma

Severe acute asthma at **emergency department**

Design

① Placebo

② IV MgSO4 (2 g in 20 min)

③ Nebulized MgSO4 (three 500 mg in 1 h)

Steve et al. Lancet Respir Med 2013;1:293-300

"IV MgSO4 >> nebulized MgSO4 ≒ Placebo"

	Nebulised $MgSO_4$ (n=332)	Intravenous $MgSO_4$ (n=394)	Placebo (n=358)	Overall (n=1084)
Status at 4 h				
Admitted	254 (77%)	279 (71%)	278 (78%)	811 (75%)
Discharged	77 (23%)	114 (29%)	80 (22%)	271 (25%)
Died	0	0	0	0
Unknown	1 (<1%)	1 (<1%)	0	2 (<1%)
Subsequent hospital admission within 7 days	15 (5%)	10 (3%)	7 (2%)	32 (3%)
Subsequent hospital admission after discharge at initial attendance	6 (2%)	5 (1%)	3 (1%)	14 (1%)
Admitted to hospital at any time within 7 days	261 (79%)	285 (72%)	281 (78%)	827 (76%)

Data are n (%).

Table 2: Admission to hospital

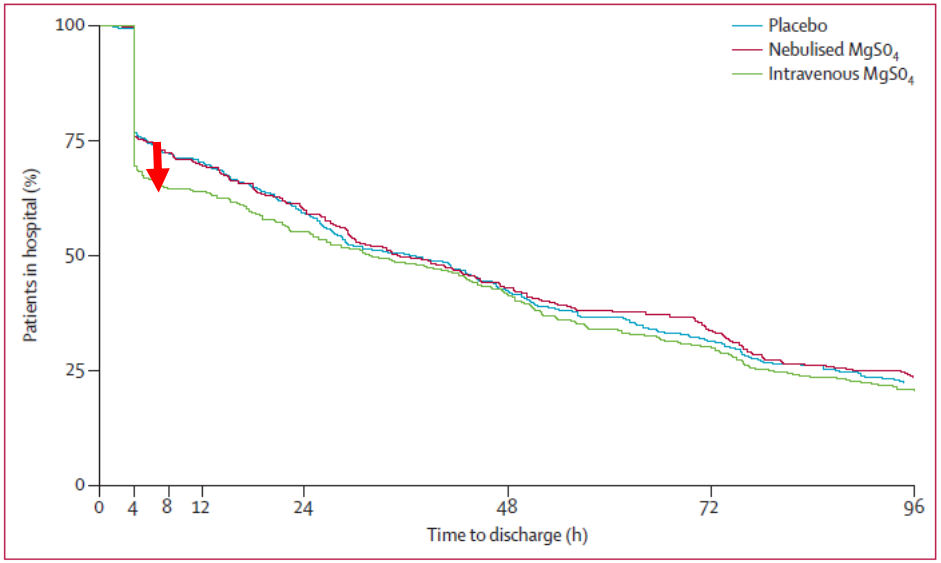


Figure 2: Length of stay after initial hospital attendance

Steve et al.
Lancet Respir Med
2013;1:293-300

Safety

	Nebulised $MgSO_4$ (n=332)	Intravenous $MgSO_4$ (n=394)	Placebo (n=358)	Overall (n=1084)
Adverse events				
Any adverse events	41 (12%)	53 (13%)	36 (10%)	130 (12%)
Arrhythmia	0	1 (<1%)	1 (<1%)	2 (<1%)
Cardiac arrest	0	1 (<1%)	0	1 (<1%)
Death	1 (<1%)	1 (<1%)	0	2 (<1%)
Intubation	2 (1%)	4 (1%)	1 (<1%)	7 (1%)
Non-invasive ventilation	2 (1%)	2 (1%)	3 (1%)	7 (1%)
Other (asthma related)	26 (8%)	26 (7%)	22 (6%)	74 (7%)
Other (non-asthma related)	14 (4%)	20 (5%)	12 (3%)	46 (4%)
Side-effects				
Any side-effect	52 (16%)	61 (15%)	36 (10%)	149 (14%)
Flushing	3 (1%)	7 (2%)	2 (1%)	12 (1%)
Hypotension	31 (9%)	31 (8%)	22 (6%)	84 (8%)
Nausea	5 (2%)	14 (4%)	7 (2%)	26 (2%)
Vomiting	6 (2%)	6 (2%)	3 (1%)	15 (1%)
Other	12 (4%)	15 (4%)	5 (1%)	32 (3%)

Total number of events will not equal the sum of individual events if a patient has more than one side-effect.

Table 6: Adverse events and side-effects

Steve et al. Lancet Respir Med 2013;1:293-300

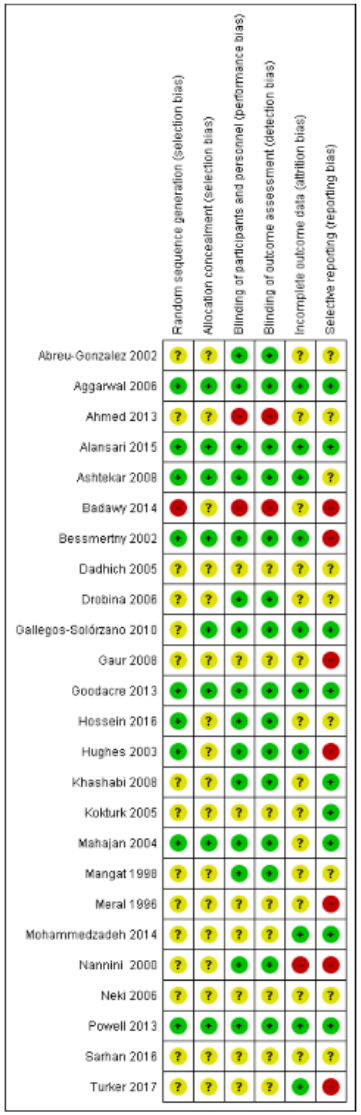
Cochrane Library

Cochrane Database of Systematic Reviews

Inhaled magnesium sulfate in the treatment of acute asthma (Review)

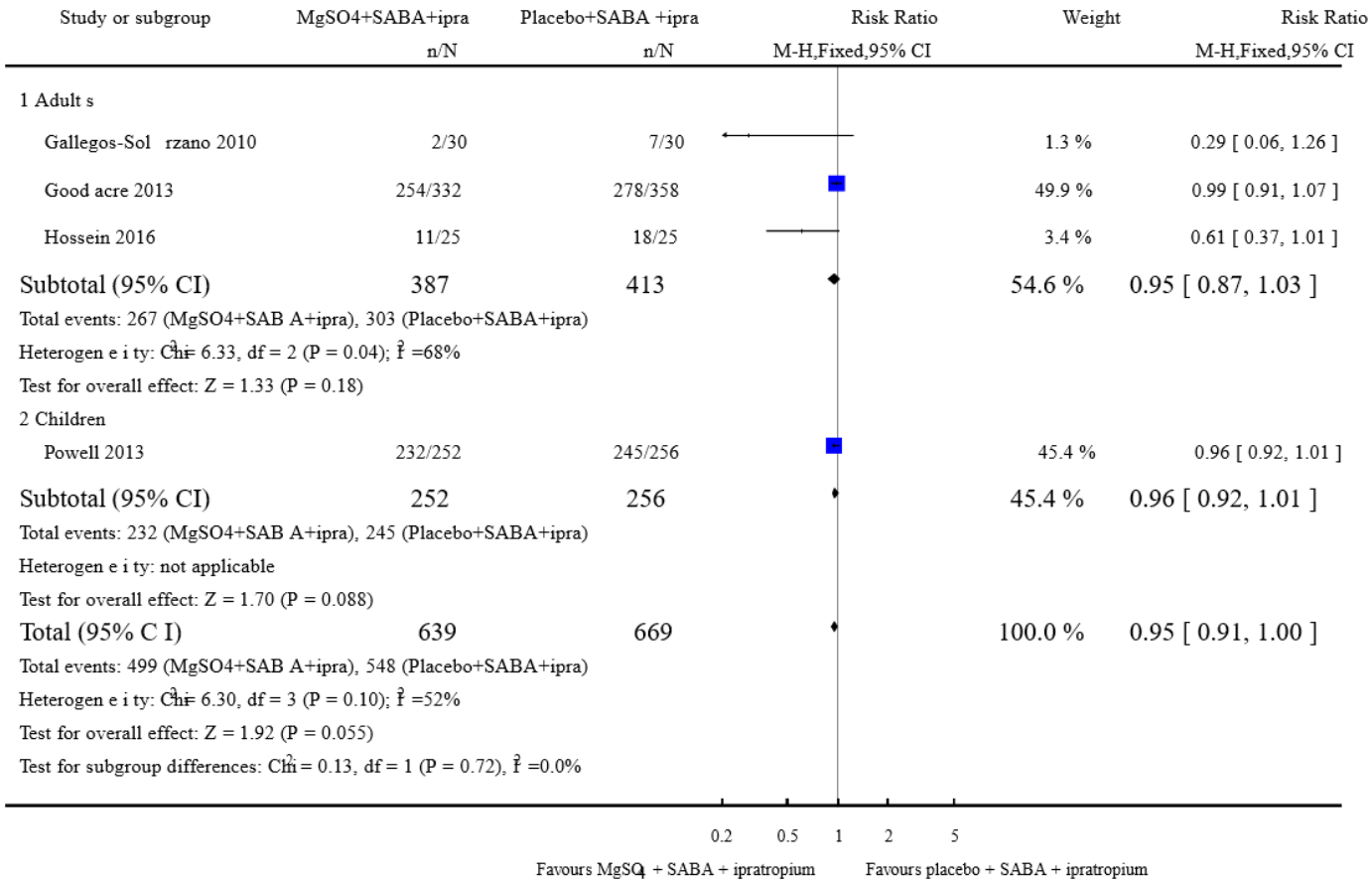
Knightly R, Milan SJ, Hughes R, Knopp-Sihota JA, Rowe BH, Normansell R, Powell C

25개 study

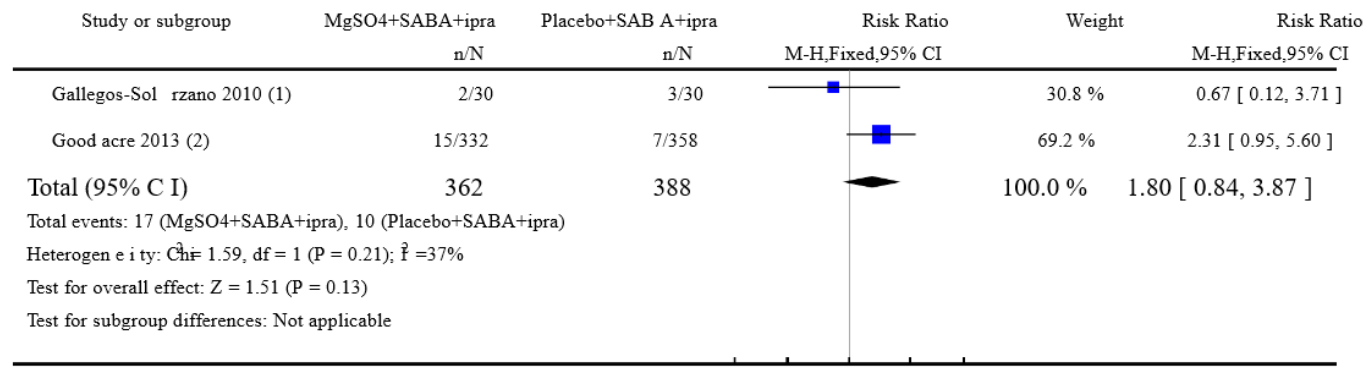


Kninghtly et al. Cochrane Database Syst Rev 2017;28;11:CD003898

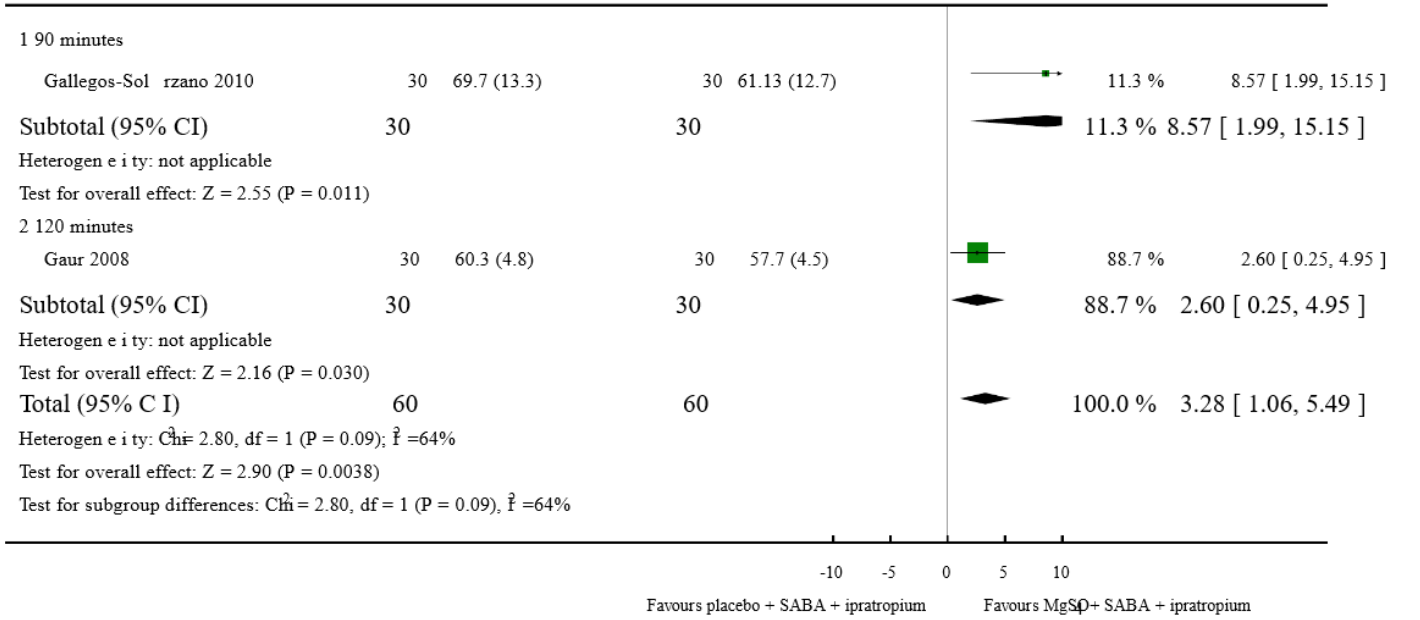
Admission at first presentation
RR 0.95 (0.91-1.00)



Kninghtly et al.
Cochrane Database Syst Rev
2017;28;11:CD003898



Re-admission
RR 1.80
(0.84-3.87)



FEV_1 improvement
RR 3.28
(1.06-5.49)

Kninghtly et al. Cochrane Database Syst Rev 2017;28;11:CD003898

3. Management in emergency dep.

3) Re-assessment (one hour after)

- **Moderate**

  : FEV_1 or PEF 60-80% & 증상 호전

  → 퇴원 계획 수립

- **Severe**

  : FEV_1 or PEF < 60% or 증상 호전 없음

  → 치료 & 재평가 반복

3. Management in emergency dep.

4) Discharge planning

▪ **입/퇴원 고려**

: 치료 전, FEV_1 or PEF < 25% 또는 치료 후, <40%시 **입원** 고려

: 치료 후 40-60%인 경우, 환자의 위험 요소 파악 후, 퇴원 고려

: 치료 후 >60%인 경우, **퇴원** 가능

4. Discharge management

4) Discharge planning

① ICS

- 처방 받은 적 없다면, 퇴원 전 ICS 처방
- 이미 ICS 사용 중이라면, 2-4주간 step-up
- 매일 사용해야 함을 강조 설명

② OCS

- 40-50 mg/day PL for 5-7 days

4. Discharge management

4) Discharge planning

③ Reliever

- 규칙적 사용 보다, 필요시 사용하도록 교육
- Ipratropium은 퇴원시 중단

④ 교육 및 예약

- 흡입기 사용법, PEF 측정법 교육
- Written asthma action plan 제공
- 퇴원 후 2일 뒤 외래 예약

SUMMARY

◆**Self-management of exacerbation:**

Written asthma action plan

Repeat reliever, SMART, ICS dose up

Short course of OCS (40-50 mg/day for 5-7 days)

◆ **Management in primary care**

Repeat SABA, controlled oxygen, OCS, controller medication…

◆ **Management in emergency department**

+) Ipratropium bromide, consider IV magnesium


Severance
With the Love of God, Free Humankind from Disease and Suffering